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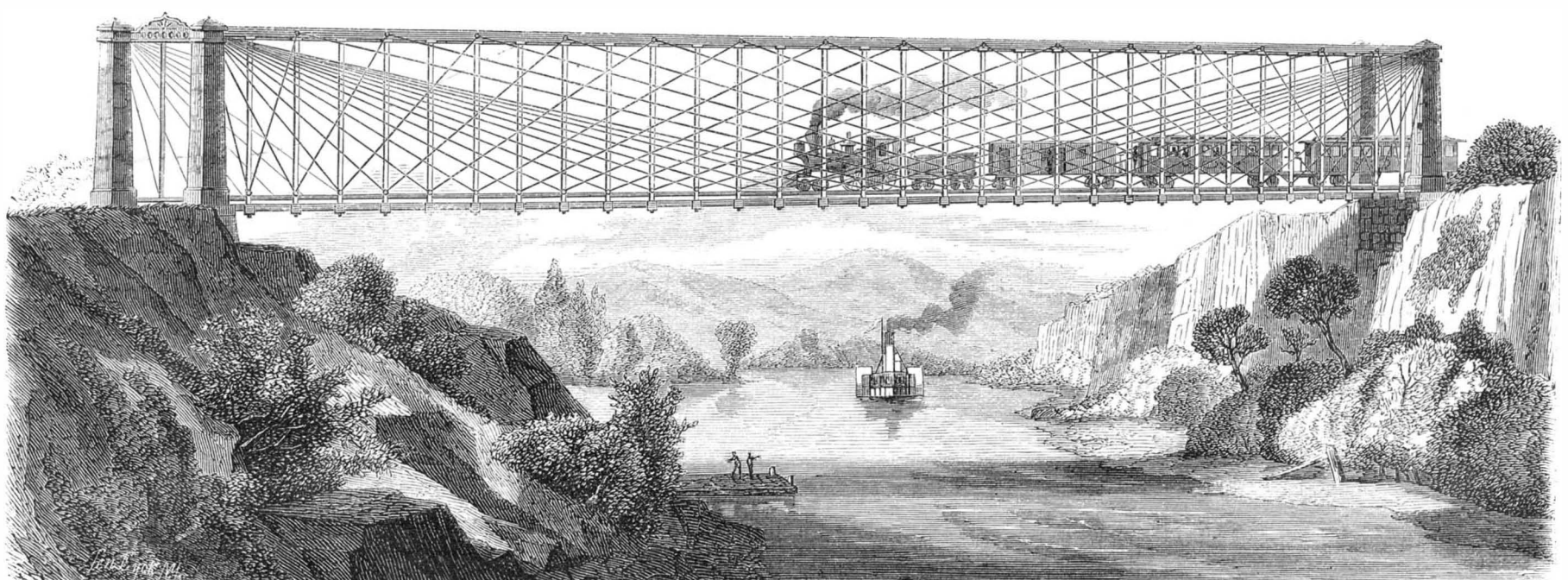
Suspension Truss Bridge.

Our engravings illustrate a light and graceful bridge, invented by Mr. John H. Diedrichs, an engineer well known to the scientific world by his valuable work on the theory of strains. His object was to produce a suspension truss for bridges which should be durable and economical in construction, and should secure from a given quantity of material a greater proportion of strength than is derived in any other truss system. This is accomplished principally by a novel and judicious distribution of the tie rods which connect the lower ends of the pendent posts with the top chord of the bridge.



DIEDRICHS' SUSPENSION TRUSS BRIDGE.

Fig. 1 shows the arrangement of these parts, which the following description will explain:

From the top chord of the bridge, which is properly supported on the buttresses, are suspended posts at suitable distances from each other, but of which posts there should be an uneven number pendent from every top chord. Tie rods or braces connect the lower ends of these posts with the buttresses and top chord; and these tie rods are applied in the following manner: From the lower end of each post, project two tie rods in opposite directions, bent at equal angles, one

Fig. 2

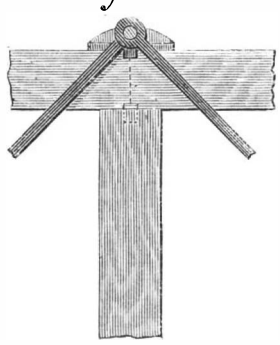


Fig. 3

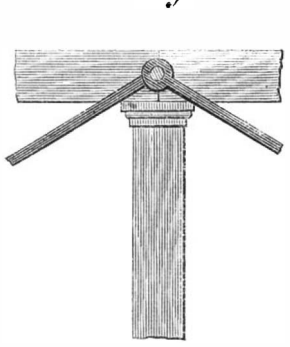


Fig. 4

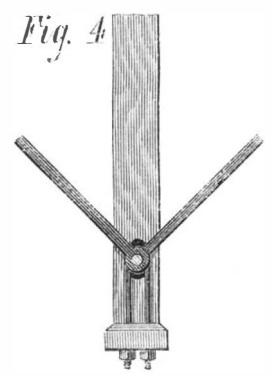
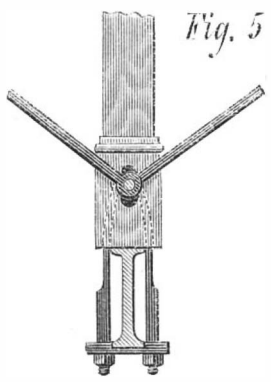


Fig. 5



of which is continued to the nearest buttress, the other to the juncture of a post with the top chord. By this means every post is connected with one buttress only, but the middle post, which is united to both. At the upper ends, only every alternate post is braced, provided they are equidistant, which arrangement is preferable in practice. The top chords and posts may be made of wood or metal. In the first case, the upper ends of the tie rods are secured, where they join, to boxes placed upon the top chord, as shown in Fig. 2. In the second, the connection may be made directly to the metallic top chord, as shown in Figs. 1 and 3. The lower ends of the tie rods, where they project from the post, are united by a bolt passing through a vertical slot in the post. A strap is laid round the bolt in the slot, and its two ends passed through a plate at the bottom of the post and secured by nuts, as shown in Fig. 4. By this mode of fastening, the tie rods are made adjustable as to their length, and the tension on them can be regulated with extreme nicety. Fig. 5 shows an elongated form of strap adapted to the support of transverse beams below the posts.

The contraction and expansion consequent on changes of temperature cannot give rise to undue strain on the parts of this bridge, as the tie rods projecting from each post are of equal lengths. A lateral shifting of the connecting pins from the above causes is also rendered impossible, which is a feature of great importance. The system admits of the use of equally thick rods throughout bridges of considerable length, though the rods nearest the middle may be made somewhat thicker than the others. The peculiar distribution of the tie rods relieves the top chord of excessive strain, and the special bracing of panels is rendered unnecessary, while the general appearance secured is light and harmonious.

The improvement was patented through the Scientific American Patent Agency, April 2, 1872. For further information address John H. Diedrichs, care of Mr. C. Gewecke, 115 North Front street, Baltimore, Md.

Powdered Coal for Unhealthy Plants.

In a communication, addressed to the *Revue Horticole*, the writer states that he purchased a very fine rosebush, full of buds, and, after anxiously awaiting their maturing, was greatly disappointed, when this took place, to find the flowers small, insignificant in appearance, and of a dull, faded color. Incited by the suggestion of a friend, he then tried the experiment of filling in the top of the pot, around the bush, to the depth of half an inch, with finely pulverized stone coal. In the course of a few days, he was astonished at seeing the roses assume a beautiful red hue, as brilliant and lively as he could desire.

He tried the same experiment upon a pot of petunias, and soon after, all the pale and indefinite colored ones became of a bright red or lilac, and the white petunias were variegated with beautiful red stripes. Some of the lilac petunias became a fine dark blue. Other flowers experienced similar alterations; those of a yellow color alone remained insensible to the influence of the coal.

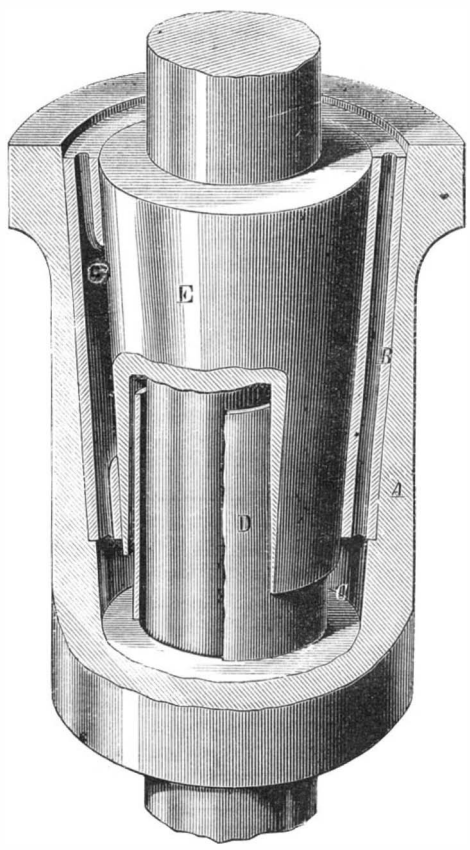
Railway Torpedoes.

A neat and effective device for securing convenience and safety in railroad operations is the "torpedo" or alarm signals. This little affair consists of a tin box about the size and shape of the smallest sized blacking boxes. The box is filled with an explosive compound, and two strips of tin are soldered to two opposite sides of the box, perpendicular to its sides or edges, for fastening it to the rail. These boxes explode on the principal of the percussion cap, with a loud report. They are in use on some roads for night signals and in foggy weather, when lights or flags would not be seen in time to prevent accident. Track men are provided with these torpedoes, and in case of danger they are placed on the rail, far enough from the place of danger to prevent disaster. Usually three of them are placed, a few feet apart, to insure their being heard by the engineer. They are reliable, and will explode at the touch of the wheel at the slowest speed.

It is said that the Reading company uses 35,000 of these torpedoes per annum on the roads which it operates. This is a good showing in favor of the contrivance, and doubtless many serious accidents are prevented by their use. They cost but a trifle. The Reading company is always ready to adopt good improvements. Some genius might do a good thing by contriving a plan by which a torpedo could be placed on the rail at drawbridges and switches in case of misplacement.

SELF-LUBRICATING BOX AND SHAFT BEARING.

In this invention, centrifugal force is utilized for the pur



pose of lubricating upright bearings. Our engraving shows the several parts of the device, partly in sections and partly in perspective. A is the outer shell of the box, which is lined with the composition metal, B. Through this lining up

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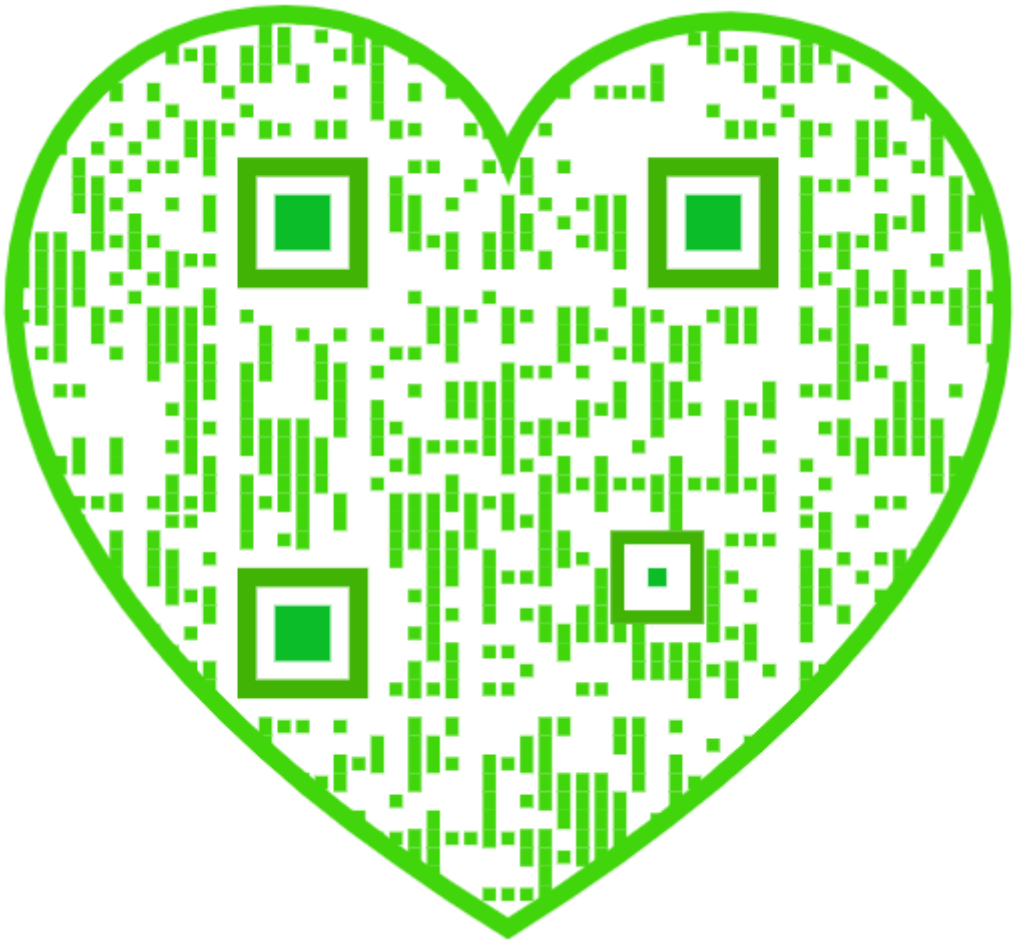

right passages are made, as shown in the engraving, extending from the circular oil chamber, C, to the top of the box. D is a sleeve which projects upwards from the bottom of the box around the shaft and forms the inner wall of the oil chamber. It does not touch the shaft. Projecting downward over the sleeve into the oil chamber is an enlargement of the shaft shown at E. It is so chambered out as to admit the sleeve without touching it. This enlargement is turned so as to form a taper bearing, larger at the top than at the bottom, as shown.

The operation is as follows: The rotating shaft carries with it the enlargement, E, and produces centrifugal force in the oil chamber, by which the oil is driven up the passages in the lining, B, and through apertures therein to the sides of the bearing. The same force also carries up the oil between the bearing and the lining to the top of the box. Surplus oil at the top is returned by the passages to the oil chamber, into which the drippings from the bearing fall. The bearing is thus made to move constantly in oil, and when running at considerable speed never comes in contact with the box, as the centrifugal force developed is sufficient to keep a sheet of oil always between them under any ordinary pressure on one side of the shaft. This has been proved in practice; and shafts fitted on this principle, and rotating 4,500 times per minute, have run for fourteen months without sensible wear of the box or need of readjustment. They can be run for months without re-oiling, as, by the construction, no oil can escape, and it must consequently be all used up.

A patent for this device has been granted, February 13, 1872, to Mr. J. P. Grosvenor, of Lowell, Mass., from whom further information may be obtained.

Cholera and Sun Spots.

Mr. B. G. Jenkins recently read, before the Historical Society of London, a remarkable paper on cholera, in which he maintained that the disease is intimately connected with auroral displays and with solar disturbances. "I believe that I am able to show that a remarkable connection exists between the maxima and the minima of cholera epidemics and of solar spots. You are all probably aware that the great astronomer Schwabe discovered that the sun spots have what is called a ten year period; that is, there is a minimum of spots every ten years. It was also discovered that the diurnal variation in the amount of declination of the magnetic needle has a ten year period. The same was proved in regard to earth currents, and also auroræ. The maxima and minima of the four were found to be contemporaneous. This was a great result; but Professor Wolf, on tabulating all the sun spots from the year 1611, discovered that the period was not ten years, but 11·11 years. This period is now the accepted one for the sun spots, and it has been established for the magnetic declination, and by Wolf for the auroræ. Now, it is a curious fact that the last year of every century, as 1800, has a minimum of sun spots, so that the minima are 1800, 1811·11, 1822·22, 1833·33, etc. The maxima do not lie midway between the minima, but anticipate it by falling on the year 4·77 after a minimum; for example, 1800 was a minimum year, then 1804·77 was a maximum year. Now, cholera epidemics have, I belive, a period equal to a period and a half of sun spots. Reckoning then from 1800, we get as a period and a half the date 1816·66, which was shortly before the great Indian outbreak; another period and a half gives 1833·33, a year in which there was a maximum of cholera; another, 1849·99, that is, 1850, a year having a maximum of cholera; another, 1866·66, a year having a maximum of cholera; another, 1883·33, as the year in which there will be a cholera maximum. It follows from what has been already said that 1783·33 would be a year in which cholera was at a maximum. Now it is a fact that in April 1783 there was a great outbreak of the disease at Hurdwar.

I am not, however, prepared to say that sun spots originate cholera; for they may both be the effects of some other cause, which may indeed be the action of the other planets upon the earth and upon the sun.

My own opinion, derived from an investigation of the subject, is that each planet, in coming to and in going from perihelion—more especially about the time of the equinoxes—produces a violent action upon the sun, and has a violent sympathetic action produced within itself—internally manifested by earthquakes, and externally by auroral displays and volcanic eruptions, such as that of Vesuvius at the present moment; in fact, just such an action as develops the tail of a comet when it is coming to and going from perihelion; and when two or more planets happen to be coming to or going from perihelion at the same time, and are in, or nearly in, the same line with the sun—being, of course, nearly in the same plane—the combined violent action produces a maximum of sun spots, and in connection with it a maximum of cholera on the earth. The number of deaths from cholera in any year—for example, the deaths in Calcutta during the six years 1865 70—increased as the earth passed from perihelion, especially after March 21, came to a minimum when it was in aphelion, and increased again when it passed to perihelion, and notably after equinoctial day; thus affording a fair test of my theory."

American Sailors as Firemen.

The American squadron, consisting of the *Wabash, Congress, Brooklyn, Plymouth, Shenandoah, Juniata* and *Wachusette*, under the command of Admiral Alden, recently lay in the Napoleon Basin, at Marseilles, France, amid innumerable merchantmen of every description and from every nation. Shortly after midnight, an explosion startled the city, followed by fire and dense clouds of heavy smoke which issued from an Italian ship just arrived from Philadelphia with a cargo of petroleum. The nature of the danger soon became evident, and it seemed impossible to prevent the spreading of the fire from ship to ship, as they lay in such a mass, and a general conflagration seemed imminent, for the houses extend down to the wharf on every side. No city of France has the means to extinguish a great fire, and hence the people gathered, contemplating the scene in panic stricken, fascinated horror.

Presently a well manned boat came from the part of the basin illuminated by the blaze and pulled directly toward the burning ship. This was soon followed by another, then a third, ten, twenty, all the boats of the American squadron. A moment later men were seen on the deck of the burning ship. The silence of the people on the shore was such that they could hear, through the smothered roar and crackle of the fire, the word of command and blows of axes. The people are thinking of the hundreds of barrels of petroleum below and its possible escape on shore and communication to other ships, perhaps others with petroleum, and in imagination conceived the whole surface of the basin covered with blazing oil. Presently the burning vessel began to settle. She had been scuttled, and her cargo was now under water, the deck being level with the surface. The danger from the escape of burning petroleum was still imminent when a line of boats, lashed together stem and stern, was seen pulling away, and as the file straightened out the burning ship moved also, and was slowly towed out to the bay by over two hundred well manned oars. It was only then that an immense cheer broke from the thousands of people, who felt inexpressible gratitude for the salvation of the city.

The Steam Jet Air Exhaust.

At a recent meeting of the Institute of Mechanical Engineers, London, the President, C. W. Siemens, read a paper "On a Steam Jet for Exhausting Air, etc., and the Results of its Application." The form and application of the steam jet having remained hitherto essentially the same as in the original steam blast of the locomotive, it occurred to the writer that much might be done to improve its effect by a judicious arrangement of the parts, so as to avoid eddies in the combined current of steam and air, and to utilize more completely the initial momentum of the steam. These objects have now been effectually accomplished by the employment of a very thin annular jet of steam in the form of a hollow cylindrical column discharged from an annular nozzle. The air to be propelled by the steam jet is admitted through an exterior annular orifice surrounding the jet, and also through the center of the hollow jet; and the area of the air passages is gradually contracted on approaching the jet, whereby the velocity of motion of the entering air is so much accelerated before it is brought in contact with the steam as to avoid the great difference in the velocity of the two currents at the point where they come together, which caused the eddies that previously impaired the efficiency of the steam jet. By the annular form of the steam jet, the extent of surface contact between the steam and the air is greatly increased and the quantity of air delivered is by this means very much augmented in proportion to the quantity of steam employed. The combined jet of steam and air is discharged through an expanding delivery pipe of considerable length, in which its velocity is gradually reduced and its momentum accordingly utilized by being converted into pressure.

This improved steam jet has been applied for exhausting one of the pneumatic despatch tubes employed at the Central Telegraph Station, in London, for conveying the carriers containing telegraphic despatches from one station to another. The result of a comparative trial made with the steam jet and with a good steam engine and exhausting pump has been found to be that the expenditure of steam is about the same in the two cases in doing the same work, the advantages of the steam jet being its very low first cost in comparison with that of the engine and pump, and also its great simplicity, and the small space occupied as compared with an engine and pump.

Another application of the steam jet is to the lifting of water from a moderate depth, by employing the jet to exhaust the air from a closed vessel, into which the water then rises under the pressure of the atmosphere, the hight of lift depending upon the size of the jet and the pressure of steam, and the consequent degree of vacuum obtained in the vessel. The discharge from the steam jet, being then admitted into the top of the vessel, allows the water to escape through a delivery valve in the bottom and aids in its expulsion. By using a pair of these vessels in conjunction, and putting the exhausting jet in communication with each alternately, by means of a self acting float and reversing valve, one vessel is filling while the other is discharging, and a continuous delivery of water is thus obtained.

It is also proposed to apply the steam jet for exhausting the vacuum pans employed in sugar boiling, so as to dispense with the present costly vacuum pumps and steam engine and the condenser for condensing the vapor from the evaporating pan; the supply of condensing water, which in many places in the sugar growing colonies is a consideration of vital importance, will thus be rendered unnecessary. The steam jet is further expected to prove very useful for draining the molasses from the sugar, by exhausting the air from below the perforated bottom of a strainer containing the undrained sugar, whereby the present modes of draining by gravitation or by centrifugal strainers can be superseded with advantage.

Numerous applications have been made of the steam jet as a blower for accelerating the distillation of fuel in gas producers for heating purposes, the jet being admitted into the space underneath the fire grate, which is enclosed by doors. By this means it is found that coal dust of the most inferior description may be used, and the rate of production of the gas is doubled, while at the same time its quality is improved, owing to the generation of hydrogen from the steam which enters intermingled with the air.

A specimen was exhibited of the steam jet apparatus; and the particulars were given of the proportions which have been found by experiment to be attended with the greatest efficiency, rendering the jet capable of realizing results comparable with those obtained from a steam engine working an air pump.

British Army Telegraph.

For this service there is at present one troop of the Royal Engineer train which is divided into three sections, each carrying twelve miles of wire, in half mile lengths. These pieces can be conveniently joined by an ebonite jointer which makes a practically watertight joint in less than half a minute, and which in the case of searching for faults, can be undone in even a less time. The cable consists of a strand of seven No. 22 B. W. G. copper wires, insulated by Hooper's compound and made three inches thick; it weighs 300 pounds per mile. For service it is carried on wooden drums, which again are placed on the "wire wagons," and are to be drawn by six horses. The wagons consist of an under carriage and wheels of an ordinary service wagon, the whole made as light as possible of "Clarkson's material." Upon this carriage are ranged six drums in two rows, so placed on framework that the wire may be paid out as required from the rear drum as the wagon advances. Thus on each wire wagon is carried three miles of wire and two dozen iron poles intended to lift the wire overhead when passing cross roads; for, although the insulation is so strong and good that it has stood and will successfully stand a great deal of ill treatment, such as carts and carriages passing over it when laid unprotected on a hard macadamized road, yet it is not to be expected that anything less durable than a rod of iron could stand the traffic of an army. The poles are formed of wrought iron tubing in two lengths, the butt ten feet long and one and a quarter inches in diameter, the top nine feet long and one inch in diameter fitting inside the butt and fastened, when in use, by a bayo' net catch. These poles can be stayed, if necessary, by three guys provided for the purpose. The wire is held in a wooden plug which fits into the top of the pole.

There is also carried, by each wire wagon, a hand barrow which is fitted with legs, and, as occasion demands, with wheels, so that it is capable of taking a drum of cable when the wire wagon may either not be able or not required to go. There are, moreover, two wrought iron earth plates eighteen inches long, four and a half inches wide, and some one half inch thick, which are strong enough to be driven home in any possible soil, and a six gallon cask of water to insure some moist earth. This, with a jointed ladder of two nine feet lengths, and some spikes to lift the wire on to a wall if wanted, comprises the main part of the furniture. There is a very neat arrangement on the hind wheel, by means of which the wire when laid out can be rolled up by the action of that wheel. Finally, there is a little hooked stick for lifting the wire as delivered on to the hedges or fences which ordinarily bound the road. The office wagon, not unlike a travelling photographer's van, contains a pair of Morse recording instruments fitted with Siemens' polarized relay, and with Digny's felt ink roller, which has been deliberately preferred, to the possibly more scientific arrangement of Messrs. Siemens, as being more portable. The pattern of battery at present in use is a form of Daniell's, arranged for portability by Sergeant Mathison, R. E., of the Electrical School at Chatham. This school is intended to facilitate the training of men from the ranks to the duties of telegraphers.

Thermometrical Experiments.

The Providence *Journal* describes the following interesting experiments made in that city with an excellent glass mounted thermometer.

In the house with open windows, it stood at 90·2°. Out of doors in the shade, at 95°; freely suspended in the sun, six feet above the greensward, 99·5°. In the same position, with wet bulb, 79·9°; with bulb covered with black silk, 169·96°. When laid upon the grass in the sun, it rose to 104°. Laid upon white cloth, placed upon the grass, 105·0°, and when similarly placed upon black silk, it indicated 113°.

The experiments with different colored coverings show very conclusively the utility of light colored clothing for those who are obliged to be exposed to the direct range of the sun at high temperatures; and the experiment with the wet bulb shows as clearly the value of free perspiration in keeping down the temperature of the body, which, however, the observer finds in his own person, notwithstanding the perspiration while making these experiments, to have risen to 100·5°, which is about two degrees above the usual standard for cooler days. The average temperature of the healthy human body throughout the year, in temperate climates, is 98·4°; while in tropical regions it is about one degree higher

DURING a recent fire at Ithaca, N. Y., one of the steamers was stationed on the high bridge over Fall Creek, just below the foot of the main fall. When the fire was nearly out, the bridge, without any warning by cracking, fell, carrying with it the engine and the people who had congregated there to the number of about 200. The bridge was 20 feet above the water, and the whole of it went down together. Fifteen persons were seriously injured.

SEVERAL citizens of Sacramento, Cal., having been poisoned by the use of what is there known as the "sanitary composite" water pipe, the Board of Health have ordered its use to be discontinued. Water flowing through this pipe was found, on chemical analysis, to contain lead and arsenic. The pipe in question is believed to be composed of a species of brass.

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ALLOYS FOR BELLS, GONGS, CYMBALS, ETC.

The alloy for bells, known under the name of "bell metal," is generally composed of copper 78, and tin, 22 parts; total, 100 parts. This alloy is a yellowish white color, hard, brittle, difficult to file, and with a crystallization without luster. It acquires a certain malleability when it is rapidly cooled off, whether by immediate exposure of the casting to the air, or by being dipped in water. From analysis of old bells, made by modern chemists, it has been found that the proportion of tin varied from 20 to 26 parts to 100 of copper. These bells were rarely manufactured with new or pure metals; therefore, the analyses have often shown the presence of foreign compounds useless or detrimental to their qualities, especially certain white metals, such as zinc and lead. The former metal when in small proportion, may not really prove a defect in bell metal. It has even been tried purposely in certain alloys. Indeed, although zinc neither improves the quality nor the sonorousness of the alloy, it does not act very badly, and allows of the manufacture of cheaper bells, which, however, are not so perfect as those made of copper and tin alone. It is not so with lead, which, if present—even in a very small proportion—in bell metal, will impair its sonorousness and hardness: therefore lead must be avoided at all events. We do not see any serious objection to the introduction of zinc into the bell metal, provided too much of it be not added. A small proportion of zinc renders the alloy more homogeneous, dense, fluid, and ready to acquire the tint of old bronze. It also gives a more economical metal, which explains the sensible reduction in the price of bells at present manufactured on a large scale in certain works. These manufacturers will soon crush the strolling melters, who for centuries had the monopoly of the casting of bells.

The new manufacturer of bells tries to work rationally; he analyses and experiments with various compositions, in order to apply the metals to the best advantage. In the past, on the contrary, there were no other rules than that of the thumb, and old metals were employed, such as broken kitchen utensils, spigots, tinned copper, with solder, etc., which could give but dubious results. If we add to that the want of precise data as to the proportions, the alteration by fusion of the alloys of copper and tin, etc., we must not wonder at the differences shown by the analyses of various bells. These variations were ascertained, especially during the crisis of the French revolution, when the church bells were taken for the manufacture of cannon and coins. Besides copper and tin, the presence of zinc and iron was often detected, and also, but not often, that of silver and gold. The presence of the latter was less frequent than is generally supposed. If some credulous minds at certain epochs have brought precious objects of gold and silver to be added to the bell metal, in order to gain indulgences or to make a pious offering, we must believe that the founders were smart enough to pass the valuable offerings through a less ardent fire than that of their furnaces; as, witness the celebrated bell of the belfry of Rouen, known under the name of the "silver bell," and which was believed by tradition to contain an enormous amount of silver. Its analyses, however, made by the learned chemists of the Paris mint, gave: Copper, 71; tin, 26; zinc, 1·8; and iron, 1·2; total 100 0; and not a trace of silver! As we have already said, it is difficult to preserve the ultimate proportions of bell metal; this is also true of alloys. It is therefore necessary to increase the proportion of tin if we desire that the alloy should have the composition demanded. But whatever be the excess of tin added, we can never arrive at a perfectly exact composition on account of the oxidation during the fusion, variable with the fire and shape of the furnace, and of the phenomenon of separation which takes place in the mold, if the metal has not been well stirred and properly cast.

From experiments on samples of bell metal made at different times, we have ascertained variations in the alloy from 18 to 35 parts of tin for 100 of copper, In order to counterbalance the loss of tin in the alloy, we believe that without increasing the proportion of tin, a bell metal might be composed of copper, 79; tin, 23 ; zinc, 6: total 108 parts. If we suppose that the fire is properly managed, and that no unforeseen accidents take place during the melting and the casting, the cast bells ought to have a ultimate composition of copper, 78; tin, 20; zinc, 2; total, 100 parts, which corresponds to a hard, tough, and slightly malleable metal, the sonorousness of which has not been sensibly changed by the presence of zinc. The quality of bells, in regard to sound, resistance, etc., also depends upon the shape and particular processes of molding and casting, outside the question of the alloy.

Zinc, and even lead, are employed in England for the casting of bells; but if the latter metal is tolerated at all, the the proportion must be exceedingly small, just enough to perfect the homogeneousness of the alloy.

Several analyses of modern English bells give, on an average, copper, 80; tin, 11; zinc, 6; and lead, 3; total 100. In old bells of the same country, an exaggeration of tin has been found, as much as 40 per cent of the alloy. These bells were exceedingly thick, and their shape was widely different from the forms recognized by our present founders.

In France also, the proportion of the white metals, such as tin and zinc, is exaggerated, especially in the alloys for hand bells, clock bells, etc. For such objects, the common alloy employed is a sort of *potin* (yellow pewter) made of copper, 55 to 60; tin, 30 to 40; zinc, 10 to 15; while the metal for gongs and cymbals is composed, on an average of copper, 75; and tin, 25; total 100. This metal is whiter, more sonorous, more brittle than bell metal, and is not so easily filed. Chinese gongs, analyzed by Mr. Darcet in 1832, have shown 78 parts of copper to 22 of tin, and a specific gravity = 8·815.

The composition for cymbals, admitted in the shops of the school of Châlons, after the experiments by Mr. Darcet, was copper, 80·5; and tin, 18·5; total 100·0. These alloys are brittle and cannot acquire the desired resistance and sonorousness, unless they are dipped into cold water after being heated up to a certain point. The alloys of copper and tin possess the property which we have already mentioned of becoming very malleable after having been brought up to a red heat and immersed in cold water. This property is made use of in the manufacture of gongs and cymbals.

These instruments, cast in a slightly loose and green sand, in order to avoid any fracture by shrinkage, are then brought up to a red heat, and dipped into water with certain precautions. After this operation they may be forged and hammered. The proper pitch is imparted to them, either by the tempering process, or by a more or less protracted hammering at certain places, or by annealing them after they have been hardened by the hammer.—*Ironmonger.*

Our Need for Artesian Wells.

Midway between the Mississippi and the Pacific lies an elevated plateau of land, over three thousand feet above the level of the sea, uninhabited and uninhabitable—the American Sahara,—six times larger in area than the six New England States. The soil is rich in every element that combines to produce vegetation; the atmosphere is pure and healthy; nothing is needed but water. For twelve hundred miles the traveller follows the westward course of the sun without the sight of grass or tree, except where some stream gives life and greenness to its narrow margin: he sees nothing in all his course but the dry, gray, sage brush, contemptuously known to miners as grease wood. This great plain is above dew point; rain is a comparative stranger; and the streams that start through the mountains, after a short fight for life, sink away into the sands of the desert. To tap these springs, uselessly sparkling in their underground darkness, it is only necessary to bore a hole not far from five hundred feet deep, and at an average expense of about five thousand dollars; and in return for this trifling outlay, the surrounding territory will be converted into the home of man.

When water can be obtained, no part of our country is more productive. Polygamous Utah presents a city whose streets gladden the eye with foliage and the ear with the ripple of water; and the population about the city raise enough for its consumption and for large sales to traveler and to outsider. The young colony of Greeley grows apace on the strength of its water, brought from afar. Whenever this can be secured, agriculture follows. To obtain this element, one man proposes to dam up the Colorado, and scatter its waters over the plain; others offer to catch the snow cold streams as they leave the base of the mountains, and distribute them among the neighboring farms. But these sources of supply would be literally but drops in the desert, compared with the great extent of waterless territory, and would be entirely local in the amount they would furnish. There is but one certain source of supply for irrigation or consumption, and that is by artesian wells.

The oldest artesian well in Europe is at Lillers, in the *Pas de Calais*, and from its mouth water has flowed uninterruptedly for seven hundred and forty-six years.

Most valuable of artesian wells—valuable not so much for its large amount of water as for its contribution to science—is that of Grenelle, in Paris. It was sunk eighteen hundred and two feet below the surface of Paris, or sixteen hundred and ninety-eight feet below the level of the sea, before it reached water. Such is the force of hydrostatic pressure, that the water is not only impelled eighteen hundred feet to the surface of the earth, but gushes upward one hundred and twenty two feet farther, supplying more than half a million of gallons a day of pure, soft water for municipal use. It has fully repaid its cost in its benefit to Paris; it has also benefitted the world and Science by proving the correctness of geological theories. The student foretells to us the inner structure of the earth before the first blow of the pick is struck, and makes known a certainty of water where the only surface signs are sterility and barrenness.

The deepest artesian well in this country, and one of the deepest in the world, sunk by the Messrs. Belcher for their sugar works near St. Louis, brings to light nearly five thousand gallons an hour; but its warm temperature of 73° Fahrenheit and its saline qualities render it unfit for most purposes.

Japanese Carved Work.

It is a somewhat remarkable fact that, in all the varieties of ornamentation applied to such materials as porcelain, textile fabrics, paper, and in pictorial illustrations generally, the Japanese never resort to shadows for the purpose of giving the effect of relief. It is a remarkable fact because, as a race, their artists are passionately fond of relief in everything, and adopt it everywhere it can be properly used. They acknowledge the great law in decorative art that flat surfaces should not appear to be relieved, but be treated as flat surfaces; and they adopt relief only where it can be properly used. When relief is wanted, the Japanese artist has countless expedients for securing it; in porcelain, he molds it from the clay, or applies it by lac; in metal work he casts it, sculps it, or beats it up; in ivory and wood, he carves it; in lacquer work, he brings it up by coat after coat of varnish; and in embroidery, he plies thread over thread with patient care until the relief is gained. Of all the carved work of the Japanese, the most wonderful and interesting are their ivories, called *netszkes*. These consist of groups of figures and animals, grotesque figures and representations, in short, of nearly every natural object in Japan, most truthfully rendered. It is quite impossible to give any idea in words of the quaint humor, the broad caricature, the intense power of expression, and the general artistic excellence which stamps every *netszke* in which the human form appears with an individuality distinct from all kinds of a kindred nature produced in other lands. A firstrate Japanese *netszke* has positively no rival. The carving of these ivories is carried to the highest degree of perfection, and its effect is frequently enhanced by the partial application of color and gilding. The Japanese are likewise skillful in wood carving, and they frequently substitute it for ivory in their small works.

Ocean Waves.

Wilkes, in 1839, made a careful measurement of waves on one occasion when the sea appeared regular and the waves of a great height. This was his method: The schooner *Seagull* was sailing in the wake of the brig *Porpoise*, and distant from her by about two waves. Their relative positions did not seem to vary, and they were sailing eight knots an hour. Casting the log from the *Porpoise*, Wilkes observed that the clip, when on the top of the nearest wave, was 330ft. distant, or one sixteenth of a mile, and the *Seagull* on the top of the next wave, twice as far, or one eighth of a mile. The time taken by a wave to come from the *Seagull* to the *Porpoise* was, on an average, thirteen seconds. This gives 26½ miles per hour for their apparent progressive motion. For observing the hight, Wilkes chose a moment when the *Seagull* was in a hollow, and the two crests were in a horizontal line with his eye, this line cutting the *Seagull's* mast at a certain hight. His observation gave 32ft. as the wave hight. Various observations have been made of wave hight. The captain and officers of the *Inconstant* on one occasion saw waves that, as they showed, must have been more than 77ft., and waves have been known to reach the top of Eddystone lighthouse, 106ft. In estimating the motion of waves, it is to be remembered that the atmosphere exercises the pressure of an elastic force of about 2,000lb. on each foot of the wave surface, and this must be added to the weight of water forming the wave. From a series of experiments made by Mr. Walker, at Plymouth, the following inferences are made:—1, The speed of waves is retarded in proportion as the water becomes shallow, and depth facilitates wave action. 2. The speed of waves does not depend on their hight. 3. The experiments made on a large scale seemed to confirm the result obtained by Mr. Scott Russell in another way—namely, that when the depth of the water becomes equal to the hight of the wave, the latter breaks and becomes a wave of translation.

Among the waves observed were some moving 46ft. per second; these were wide apart and of short hight. Their destructive effect on masonry was, nevertheless, very great, while certain other waves, which were higher and in closer succession, and moved 41·8ft. per second, were much less destructive. The effect being as the square of the velocity, we may calculate what should be the hight of waves which, moving at the rate of 41·8ft. per second, would have an equal effect with waves 27ft. in hight, and moving 46ft. per second (27ft. having been the hight of those observed to move 41·8ft. per second). Thus $41\,8^2 \times 27 = 46^2 \times x$, whence $x = 22$.

The hight of waves in the Mediterranean has been estimated by W. Smith as in general from 14ft. to 18ft.

Notes About Rats.

A gentleman, who has passed many years of his life at St. Helena, told me lately several stories about rats, so curious that I thought them worthy of record. He said that at one time the common brown rat was extremely common all over the island, in fact, a perfect pest; and to avoid its attacks his father had constructed a large store, rat proof: namely, a rat once in could not get out again. A number, however, came in with produce and goods from the ships, and bred there. Around this store were venetian blinds to the windows, and one day one of his men, when it was raining, watched a rat sitting on the venetian and putting out his tail to collect on it the drippings of water at the edge: he then withdrew it and licked it. The servant told his master, who immediately understood that the rats could get no water inside the store, and therefore directed that a butter firkin should be cut down to four or five inches, and in the top a large circular wire rat cage trap should be fixed. Several small planks were placed for the rats to get up to the entrance to the cage, which exactly fitted the firkin. No food would have induced the rats to enter the trap, but water did, and many were thus captured. There is one peculiarity with these rats, namely, their very often building or making their nests in the trees. I have in India several times found rats' nests in trees; but they have always been stolen nests, such as deserted abodes of the squirrel or sparrow; but here my friend, who is no naturalist, tells me that they construct them principally of fir spines, on the ends of the boughs some twelve or fifteen feet from the ground, in the common fir trees. The spots selected are just where the overlapping bough nearly meets the lower one. He said that all know the rats' nests, and that he had seen them fired at, when many rats were killed and fell out to the ground. He could tell me no more, and I think that, if original nests, as he held them to be, some grass must be woven in their construction, as fir spines have but little power of cohesion. The situation of these nests was worthy of notice, although there is scarcely a situation where a rat's nest has not been found.—*Science Gossip.*

THE conversion of water into vapor develops electricity.

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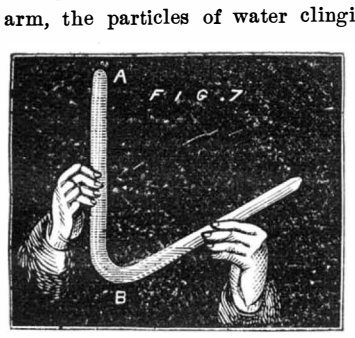
HEAT AND LIGHT.

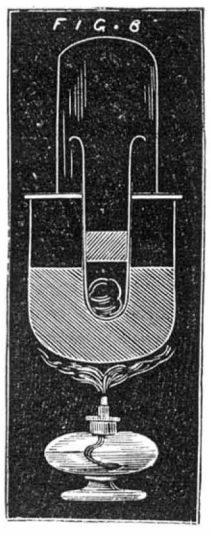
[Report of a recent lecture by Professor John Tyndall, before the Royal Institution.]

Liquids expand in general more than solids. I may here remark that the ordinary definition of the solid, liquid, and gaseous states, given in many text books, is hardly correct. Cohesion is thought to be predominant in the first state of matter, absent in the second, and negative –that is to say, that absolute repulsion exists among the molecules—in the third. But liquids may be strongly cohesive; and, indeed, the researches of many physicists have shown that there is not an absence of cohesion among, but sliding powers possessed by, the molecules of matter in the liquid state. If air is expelled from water, it is still liquid, but the cohesion of its molecules becomes very great.

To M. Donny, of Ghent, we are indebted for the discovery of an interesting property of water, illustrative of the cohesive force it possesses. On heating water, air bubbles crowd to its side long before it boils, rising through the liquid without condensation. The air thus liberated has been held in solution by the water, and one of the remarkable effects it produces is that it promotes ebullition. It acts as a kind of elastic spring, pushing the atoms of water apart, and thus helping them to take the gaseous form.

The tube I hold in my hand, which, after the inventor, is called Donny's tube (Fig. 7), contains water which has been freed from air by boiling. My friend, Mr. Justice Grove, would say it is impossible entirely to free water from air by boiling, but this water has been very nearly freed. Having lost the cushion which separated them, the cohesion of the atoms of water is vastly augmented. One effect, as you hear, is that the water, running from end to end of the tube, strikes against it with as rude a shock as if it was a solid body. You hear the sharp metallic ring it sends forth when I turn it upside down. I bring the water into one arm of the V by tilting the tube; you see it flows freely from one arm into the other. I now tap the end of the arm containing the water on the table. At first there is a slight jingling noise; as long as you hear that sound, the water is not in true contact with the tube; I continue tapping, the jingling soon ceases, and the sound is now perfectly hard—like that of one solid against another; the interstitial air, which it is impossible wholly to exclude from the tube, has been removed, and if I now raise the tube. the water remains in (A B) the arm, the particles of water clinging so tenaciously to the

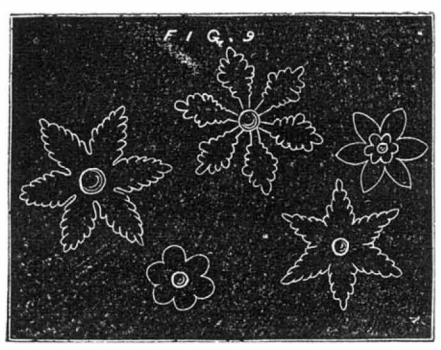




sides of the tube that it refuses to behave like a liquid body; it declines to obey the law of gravitation.

But Donny pushed his researches further, and found that the boiling point of water was very greatly elevated when the water was free from interstitial air; indeed, that it could be subjected to a temperature 50° Fah. above its ordinary boiling point before ebullition took place, and that then, instead of boiling in the ordinary way, molecule by molecule, as it were, that the whole or nearly all the water is converted into vapor at the same time with a sudden crack like an explosion.

Faraday took great interest in this experiment, but in his mind it was like the ignition of a match, which instantly produces more light. His mind may be said to have possessed the potential power of a muscle, while a new fact acted like the nerve of that muscle; possessing no force in itself, it

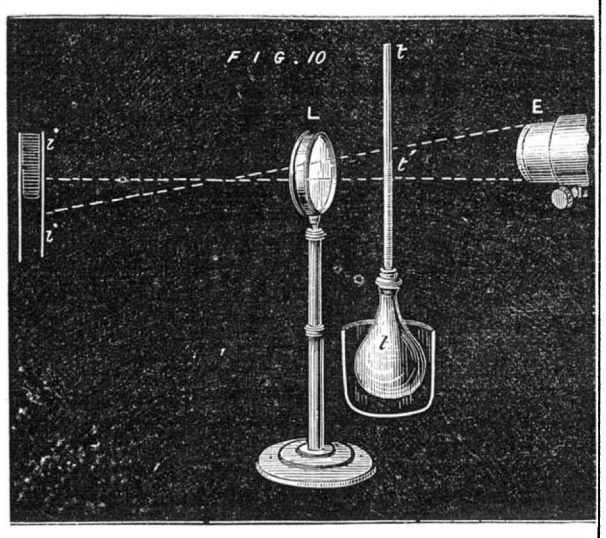


nevertheless acts as a trigger, unlocking a new force. In such a way did this fact act in the potential power of his mind.

He had known and wondered at the extraordinary power possessed by bodies, in crystallizing, of excluding air; and that water in freezing, that is, in taking a crystalline form, excludes everything extraneous to itself. Could he then get pure ice melted without contact with air, he would have water still more perfect than Donny's boiled water, and it ought to produce the same effect. Well, he surrounded his ice with oil—melted it—the oil floated on the surface of the water, and he found that the water could be heated 60° Fah. above the ordinary boiling point, and that when it did boil, it boiled with a sudden explosion.

This experiment was performed: A small lump of ice was placed in a clean test tube in an oil bath, and just covered with oil (Fig. 8), the whole being surmounted by a glass jar to avoid scattering the oil. When the water boiled, it did so with a sharp explosion, violently discharging the oil above it into the jar. A second tube, containing common water covered with oil, boiled tranquilly.

We will now send a beam of heat through a plate of ice, and take down the crystalline structure of the ice. It will pull the crystals to pieces by accurately reversing the order of its architecture; silently and symmetrically the crystallizing force built the atoms up, and silently and symmetrically the electric beam will take them down, producing the beautiful flowers with six petals, with which many of you are familiar (Fig. 9).



When these flowers are examined by reflected light, in the center of each flower appears a spot which shines with a silvery luster; these spots are not air bubbles, but a vacuum, the water occupying less space than the ice previously did. Imagine the flower forming and gradually increasing in size. The cohesion of the liquid is so great that it will pull the walls of its chamber together, or even expand its own volume sooner than give way. But as its size augments, the space which it tries to occupy becomes too large for it, until finally the liquid snaps with an audible clink, and a vacuum is formed. When I first heard this noise, I suspected my imagination to be in fault, but I soon found it to be a reality, and that when water is thus split, one can hear the rend.

Let us now return to our expansions. Most liquids expand by heat and contract by cold. Alcohol is a good example; its expansion continues till it reaches the boiling point, and it contracts again at one even rate to the lowest temperature. It has never been solidified.

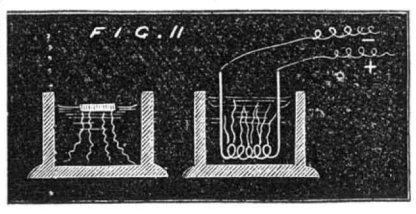
A far more interesting case of expansion is that of water, inasmuch as it exhibits a wonderful exception to the usual law of contraction by cold. If heat be abstracted from water, it goes on contracting till it reaches a temperature of 39° Fah., or thereabouts, at which point contraction ceases. This is the so-called point of maximum density of water; and from this point downwards, till the freezing point is reached, the liquid instead of contracting expands, and when it is converted into ice the expansion is considerable.

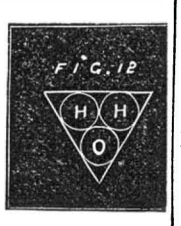
The flask filled with water, A, is tightly corked (Fig. 10); through the cork a tube, *t*, passes watertight, and the liquid rises within it. A strong beam from the electric lamp, E, passes across the tube, and by means of the lens, I, an enlarged image of the liquid column appears on the screen, *i i*. Of course the image is an inverted one, and when the liquid expands, the top of the column will descend the screen. Heating the flask by a spirit lamp, at the first instant the head of the column ascends as if the liquid contracted. This is due to the momentary expansion of the flask to which the heat is first communicated. Now it stops and commences descending the screen, and does so until the liquid reaches the top of the tube, a single drop running over.

I now cool the flask by plunging it into the freezing mixture of pounded ice and salt. You see the column gradually sinking, now a point is reached at which the contraction becomes very slow, and at last it stops altogether; and now expansion begins; putting in a little more of the freezing mixture, it rapidly increases—for the colder the mixture, the quicker the expansion—and you see it goes on till the water is actually thrust out at the top of the tube by the cold, exactly as it had been by the heat.

The force of this expansion is very great. Mr. Cottrell will place a bombshell and an iron bottle in a freezing mixture, covering them both. Before we follow the result to its consequences, we will show the manner in which heat diffuses itself through liquids.

I have here a glass cell (Fig. 11) into which I plunge this platinum spiral, *a*, which I can heat by means of a small battery, throwing upon it a beam from the electric lamp; I can, by a lens, obtain its image upon this screen, and now





making contact, the wire is heated, and heats the water surrounding it, which, as you see, rises to the surface. Taking another cell (Fig. 11) and allowing a fragment of ice to float upon the water, the difference of refraction between the cold and the warmer water enables you to see the descending current. In the one case the water streams upwards, in the other it streams fast downwards. Thus, in a general way, it is illustrated that the lighter water rises and the heavier water sinks.

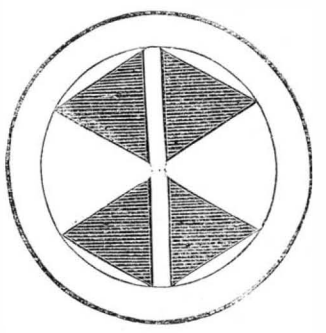
In order fully to appreciate the value, of the infraction of the general law of contraction by cooling, we may examine the case of a lake exposed to an atmosphere below the freezing point. The surface is chilled, the water contracts, becomes heavier and descends, its place being filled by the lighter water from below. This, in its turn, is chilled likewise and sinks. Thus a circulation is established, the cold dense water descending, and the lighter warmer water ascending to the top. Supposing this continued, the whole of the water of the lake would ultimately become one solid block. But just as matters become critical at the temperature of 39° Fah., the water expands by cooling, and swims like a scum on the top of the warmer water beneath. Solidification ensues, and the ice, being much lighter than the liquid, forms a protecting roof over the living things below.

When this fact was first made known, I believe by De Luc, afterwards by Blagden and Hope, it produced a strong impression. Rumford says: "Though it is one of the most general laws of Nature with which we are acquainted that all bodies, solids as well as fluids, are condensed by cold, yet, in regard to water, there appears to be a very remarkable exception to this law. . . . All bodies are condensed by cold without limitation, water only excepted. . . . This exception to one of the most general laws of Nature, a striking proof of contrivance in the arrangement of the Universe, a proof which comes home to the feelings of every ingenuous and grateful mind . . . for though the extensiveness and immutability of the general laws of Nature impress our minds with awe and reverence for the Creator of the Universe, yet exceptions to those laws, or particular modifications of them, from which we are able to trace effects evidently salutary or advantageous to ourselves and our fellow creatures, afford still more striking proofs of contrivance, and ought certainly to awaken in us the most lively sentiments of admiration, love, and gratitude;" and further on, he adds: "I feel the danger to which a mortal exposes himself who has the temerity to undertake to explain the designs of Infinite Wisdom. The enterprise is adventurous, but it cannot surely be improper." I think it is adventurous to attempt to get at the designs of Infinite Wisdom. The case of water is not exceptional. The metal bismuth expands at the time of crystallization by cooling from the molten stand. A bowl of molten bismuth becomes covered with a crust, which is broken through in little craters, as the cooling progresses.

How are we to figure this act of expansion? It is manifestly preparatory to the act of crystallization. The idea of polar force, which we are accustomed to from the study of magnetic phenomena, has been applied to crystals. They build themselves into definite shapes, hence they must arrange themselves in a definite manner, and the forces which produce this definite arrangement are now called polar forces.

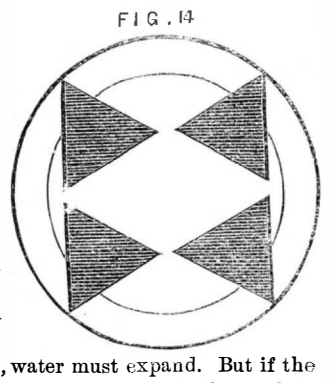
Now to revert to water. Each molecule of water contains three atoms (Fig. 12); thus the sphericity is destroyed, and we have pyramidal little masses for the molecules. Let us next take a section of a pyramid, a triangle. Suppose triangular molecules to approach each other by a mutual attraction of the general mass; the forces issuing from the poles would be for a time insensible. At last they come within each other's play, and produce immediately a re-arrangement of the molecules with respect to their axes.

FIG. 13



This model will in a rough way demonstrate the point (Fig. 13). The bases of the triangles are facing each other, as they are drawn together, the center of gravity of each being one third of the length of the line bisecting the base, drawn to the opposite angle; when they are brought thus close, we may imagine that the polar force is brought into play as against the gravitating force, and that the vertices are drawn face to face (Fig. 14). The center of gravity is two thirds from each vertex, and as you see by their encroachment on the outer circle, expansion is the result. The triangles now take up more room than they did before.

FIG. 14



[The burst bomb and iron bottle were now shown, and reference made to the influence of pressure upon the freezing point.] To solidify, water must expand. But if the vessel be rigid it cannot do so, hence, in a rigid vessel, it would remain longer liquid. For every additional atmosphere of pressure, the freezing point is lowered 1-75th of a degree Fah., and it is raised 1-75th of a degree when atmospheric pressure is removed.—*Mechanics' Magazine.*

A STATUE of Shakespeare has just been erected in Central Park, New York. The sculptor was J. Q. A. Ward. As a work of art, it is considered a great success. Some say that it is the best Shakespearean sculpture ever made. Crowds of people flock to see it.

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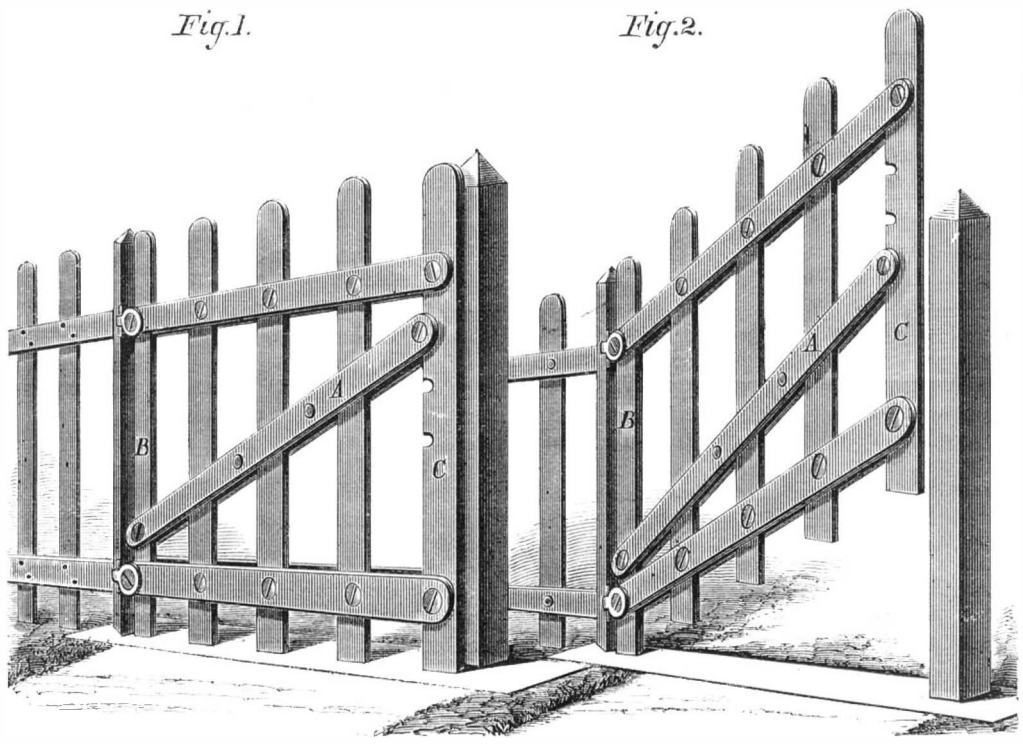
Improved Farm Gate.

Mr. E. B. Decker, of Carrolton, Greene county, Ill., has made an improvement in gates, which we here illustrate. The invention appears a good one, and is likely to obviate a great many defects in other farm gates.

Fig. 1 is a view of the closed gate. It is constructed of upright slats and horizontal rails which, instead of being firmly connected, are riveted together so as to be able to move freely round the rivets. The position of the gate is maintained by the brace, A, which diagonally crosses it. This brace is composed of two pieces, which are riveted together as shown in the engraving, the rear end being pivoted to the hinge slat, B, and the forward end being supported, by its rivet, in a notch in the front slat, C, and, at the same time, bracing the front slat, so that it cannot fall lower and bring the gate out of position. It is obvious that, if the front slat were raised, it would allow the brace to fall into the next notch, and so on until the gate reached the position shown in Fig. 2, in which the brace would firmly hold it. The brace will thus admit of the gate being raised without being opened, to allow of sheep, cattle, etc., passing under it and to clear the winter snow; while sagging is prevented in any position.

Patent is now pending through the Scientific American Patent Agency.

Further information may be had by addressing the inventor as above.



DECKER'S FARM GATE.

IMPROVED PUDDLING TOOL.

The process of hand puddling, in the ordinary reverberatory furnace used for the purpose, can be divided into four stages:

(1) Melting. The pig iron, together with a proportion of hammer slag, is charged on the bed, previously lined with either puddling mine, bulldog, or both, and plastered over with wet hematite ore. As the cast iron gets softened by the heat, it is broken into smaller pieces and stirred up with the cinder. This is done by the hand rabble, which has to be continuously moved over the whole surface of the bed. This stage lasts about thirty-five or forty minutes.

(2) In the second or boiling stage, the iron has to be violently rabbled in order to bring it into a state of ebullition or boiling. In this operation, the puddler has to exert himself very considerably, working the rabble to and fro, and from side to side, over the bed.

(3) "Coming to nature." The iron now begins to thicken and to get tougher and tougher; the "boil" stops, and it "comes to nature" or begins to assume the consistency of heated wrought iron. The puddler works it in this pasty consistency from side to side of the furnace, separating it into different pieces.

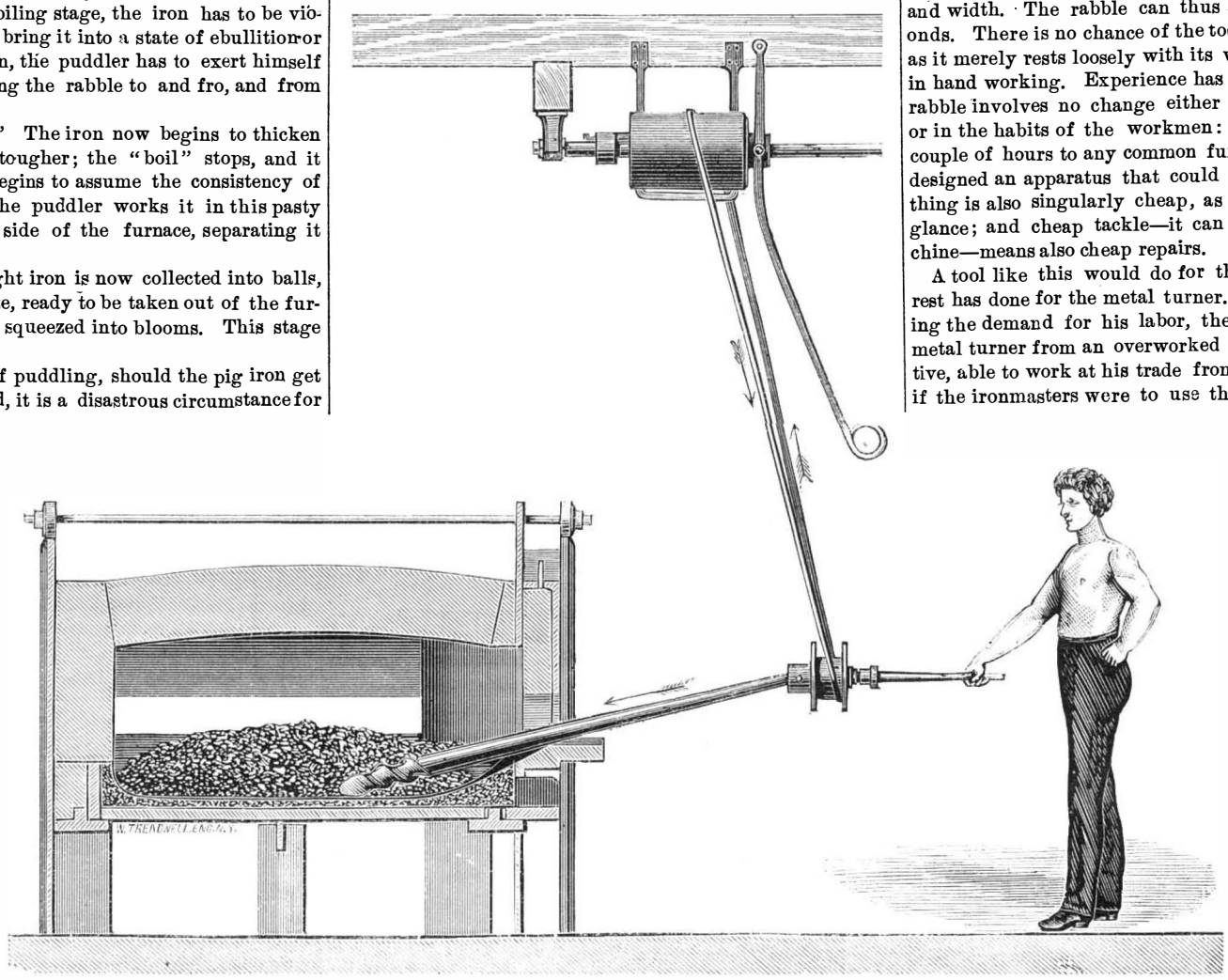
(4) Balling. The wrought iron is now collected into balls, varying in weight and size, ready to be taken out of the furnace to be hammered or squeezed into blooms. This stage takes about ten minutes.

In the ordinary mode of puddling, should the pig iron get entirely melted on the bed, it is a disastrous circumstance for the puddler. The bath of metal, with its even surface hidden under the lighter cinder, offers very slight surfaces of contact to oxidation. To meet this, he is forced to very violently exert himself in stirring up the metal; and he is obliged to shovel in quantities of hammer slag, cinder, or other sources of oxygen, which cool down the metal and lower the quality of the product.

There can be no doubt that an unaided man's strength is insufficient for this labor. Dr. Percy, whose opinion as a metallurgist, chemist, and medical man is universally known to be of the very highest importance, states that the majority of puddlers "die between the ages of forty-five and fifty years; and, according to the returns of medical men to the registrar, pneumonia, or inflammation of the lungs, is the most frequent cause of their death. This is what might have been anticipated from the fact of their exposure to great alternations of temperature under the condition of physical exhaustion." They are also liable to cataract, induced by the intensely bright light of the furnace; and the forearms and faces of some puddlers are also often scorched to a bright red tinge in a curious way. As Dr. Percy observes, "it is not surprising that puddlers should manifest a growing disinclination to bring up their children to his occupation, to which, as a general rule, their strength ceases to be equal beyond the age of forty-five or fifty." On the puddler more than Adam's curse seems to have fallen—copious drops transpire, not merely from his brow, but from all his almost naked body, while engaged in what Mr. W. Bridges Adams has termed "the absurdity of setting a number of human beings to stir up a metallic pudding in order to throw off the scum."

To Mr. Edward Hutchinson, of Messrs. Pease, Hutchinson & Co., Skerne Ironworks, Darlington, England, belongs the merit of having first invented and experimented with the revolving rabble. His trials were very successfully carried out as long ago as 1865, being, however, relinquished during the same year, and without having been published in any way. M. Dormoy quite independently took up the same idea, and has been perseveringly working it out since 1866.

Any puddling machinery must be essentially simple and non-liable to get out of order by the roughest and most careless usage. This simplicity, required by the men, is also required by the furnace; the high temperature of which, with the attendant rapid current of air passing through, must not be interfered with.



DORMOY'S REVOLVING RABBLE APPLIED TO COMMON FURNACES.

A glance at the accompanying illustration will render the whole apparatus intelligible. A common belt, driven from shafting six feet above the furnace, rotates the sheave, loosely jointed at one end to the puddling rabble, and at the other turning on a pin held in the hand of a puddler. To prevent any jarring action to his hand, the pin he holds may be wound round with spun yarn or gasket, embraced by a leathern or india rubber tube. The strap thus rotates the rabble, supports part of its weight like a suspension link, and acts as a universal joint, much as in the familiar instance of the rotating hair brush. The belt must evidently adapt itself with ease to the great variety of positions which have to be taken by the tool in every part of the furnace, to the necessity for removal when too hot, and to the progressive changes in the metal.

Mechanism could easily be applied to the rotating rabble in order to work it regularly to and fro; but this additional complication has not been found necessary. Its great speed, from 300 to 800 revolutions per minute for white pig, and from 800 to 1,000 for gray metal—is found to give it all the mechanical energy required. The end of one form of rabble, about 4½ inches in diameter, when revolving with 500 revolutions, necessarily has a speed at its circumference of nearly 600 feet per minute. On the other hand, the iron, even when boiling, is not thrown up. The centrifugal impulses are not sufficient to overcome the cohesion of the hot metal. The power required has been indicated by Herr Biedermann, now of Floridsdorf, near Vienna, at from one quarter to one half of a horse power per furnace per hour; but the draft would necessarily increase towards the end of the heat. There is no bearing near the furnace necessarily liable to get hot; no gearing to break on any sudden resistance; and the strap itself acts in its usual way as an admirable friction brake. It is difficult to imagine how the apparatus can come to grief in any other way besides breaking the strap. For such a case, a spare belt is kept hanging on the shaft; or the puddler could even merely go on in the ordinary way. If kept well greased, however, the belt lasts from three to four months without renewal. Any diminution in speed can be obtained by slightly relieving its weight off the belt—thus allowing more or less slip. On the other hand, any unusual resistance can be overcome by the puddler pressing the tool down on the belt. Simply by crossing the strap, the rabble can be rotated from left to right, or *vice versâ*, alternately, as required. The tools, in spite of their extra weight, are easily removed from the furnace by taking them off the strap, by means of a hook on a light chain suspended near the furnace from the roof, and laying them on small trestles about eighteen inches in hight and width. The rabble can thus be changed in thirty seconds. There is no chance of the tool disturbing the fettling, as it merely rests loosely with its weight on the bed, just as in hand working. Experience has shown that the revolving rabble involves no change either in the plant of the works or in the habits of the workmen: it could be adapted in a couple of hours to any common furnace: and the author has designed an apparatus that could be at once applied. The thing is also singularly cheap, as can be seen at the first glance; and cheap tackle—it can scarcely be called a machine—means also cheap repairs.

A tool like this would do for the puddler what the slide rest has done for the metal turner. While actually increasing the demand for his labor, the slide rest has raised the metal turner from an overworked drudge to a skilled operative, able to work at his trade from youth to old age Even if the ironmasters were to use the revolving rabble merely to relieve their men, and without requiring a greater number of heats from them, they would gain:—(1) A great improvement in the quality of the iron produced; (2) a great diminution in the number of ruinous "cobbles" or "wasters;" (3) the capability of working up very gray or also inferior kinds of pig, without using any "fined metal;" (4) diminution of loss in mill scale between the rolls.

Perhaps the most important truth which has been lately elicited touching mechanical puddling is its effect in improving the quality of the puddled bar. Mr. Danks has worked up almost every kind of American and British pig metal with excellent results as to quality. Mr. Adam Spencer has in his revolving furnace produced excellent iron from Middlesbrough metal containing 2 per cent of phosphorus. As already noticed, experience with oscillating rabbles points to more or less improvement in the quality. Mr. Hutchinson, as we have seen, improved the quality of Cleveland iron with his revolving rabble. M. Dormoy has puddled with success some old cannon balls the Turks left behind them at Temesvar, in Hungary, so white and containing such a large quantity of arsenic as to be utterly intractable by the ordinary process; he has also operated at Zeltweg, in Styria, upon pig metal alloyed with copper and sulphur; upon the sulphurous pig metal of the Loire and

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that of the Moselle—the latter containing very large percentages of phosphorus. In every case, perfectly tough iron and steel, often rolled into the most difficult special shapes, have been produced. It is clear to the eye of the mechanic that all these otherwise very differing apparatus are alike in one particular, namely, more or less thoroughly stirring up the first broken, then molten, and lastly pasty, metal, together with the fettling on the bed. The infinite variety of chemical conditions formed by the different kinds of pig and fettling, under which these results have been obtained in England, the United States, in France, Styria, Hungary, and Austria, clearly debar us from searching for any recondite chemical cause; and it is evident that, whether this thorough stirring be obtained by exhausting manual labor, or by an imperfect oscillating rabble, or by a revolving bed or a revolving rabble, the mechanical effect must be the same: That is to say, the molten cast iron has to be continuously stirred up in order, in the common furnace, to expose it to the oxygen entering at the door and contained in the fettling; in Mr. Danks' and Mr. Spencer's furnaces to the oxygen in the latter only.

There thus seem to be three principal reasons why mechanical puddling, or, in other words, good puddling, produces such good iron. The operation is (1) completely carried out; (2) the puddled bar is really homogeneous; (3) the multiplication of the surfaces of contact intensifies the purifying chemical reactions.

Nevada Silver.

At the recent meeting of the American Institute of Mining Engineers in New York, the President, R. W. Raymond, read an interesting paper on the silver mines of Nevada, from which we take the following:

The Eureka district stands now third in rank of the silver producing camps of Nevada. During most of the year, four and sometimes five furnaces (combinations of the Rachette and Piltz) have been in blast. Late last year, and in the earlier months of the present year, the Eureka Consolidated Mining Company discovered immensely valuable and extensive bodies of ore in the Lawton tunnel. Raby Hill is a spur of the diamond range. The openings of the Eureka Consolidated, as well as those of the Richmond and Tip Top, are on the western and the new ones on the eastern slope. The strike of the ore body is nearly east and west, and its dip about 45 degrees to the northeast. For this reason ore was first discovered on the western slope of the hill, where the vein crops out.

The Lawton tunnel is now in over 600 feet, and passes 120 feet to the north of the Keyes shaft, between it and the windsail shaft. At its end, it is in ore. The Keyes shaft is now 175 feet deep and serves as the main hoisting shaft for the old works. These are the largest extant in broken quartzite.

The approach to the vein matter is distinguished by a yellow color of the first dense, afterwards broken, limestone; next by a stronger impregnation of pulverulent brown and yellow iron ore and stripes of the first; finally, the ore body proper—brown iron ore, with impregnations and bands of carbonate of lead or lead ocher, is reached.

While on the western slope, besides the yellow memetele, large masses of solid carbonate of lead, with so called "black carbonate," which is probably a new mineral, and little galena were found. The ores encountered on the eastern slope in iron stained masses, which are poorer in lead, are principally highly argentiferous galena and "black carbonate" in lumps and nests of often over 100 pounds weight. For this reason, there is now much more base bullion praduced than formerly. Seven tuns of ore now produce one tun of lead, while formerly it required ten or twelve tuns. At Richmond, the best and most profitable smelting works in the State are building energetically. All signs point to the enormous industrial increase during the coming year, especially if capitalists should take up the Prospect Hill mines.

The total product of bullion of the Eureka Consolidated, during 1871, was about 3,172 tuns. The average contents in gold and silver for the whole yearly product may be estimated as $250 per tun. Adding $100 per tun for the lead, we have a gross value of $1,110,314·10. The gross value of the total production of gold, silver, and lead, during 1871, by the various companies, including the Eureka Consolidation in Eureka, was $2,035,588 86; the total quantity of bullion shipped was 5,665 tuns, 1,074 pounds.

All the base metal mines in the district have the same character as those previously described, and vary less in the classes of ores occurring in them than in the size of the ore bodies.

WINDOW SASHES.—The most convenient way, to prevent loose window sashes from rattling when the wind blows, is to make four one sided buttons of wood, and screw them to the stopes which are nailed to the face casings of the window, making each button of proper length to press the side of the sash outwards when the end of the button is turned down horizontally. The buttons operate like a cam. By having them of the correct length to crowd the sash outwards, the sash will not only be held, so firmly that it cannot rattle, but the crack which admitted dust and cold air will be closed so tightly that no window strips will be required The buttons should be placed about half way from the upper to the lower end of each stile of the sashes

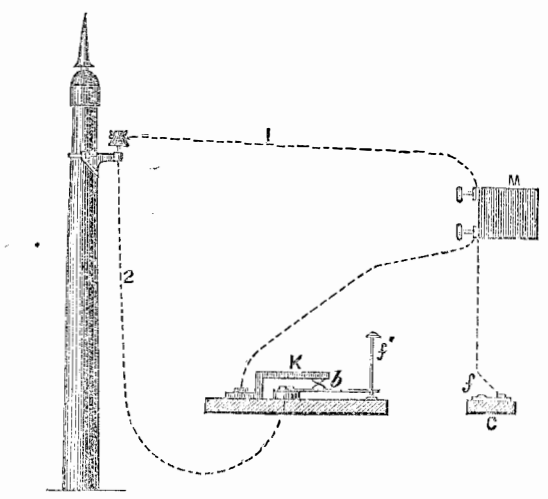
THE *Adriatic*, a new and splendid ocean steamer, recently made the passage from Queenstown to New York in seven days and sixteen hours,—the quickest westerly voyage ever made across the Atlantic.

Testing Telegraph Insulators.

Insulators usually undergo a most careful visual investigation at the factory, and all such insulators as are free from mechanical defects subsequently have to pass through a most delicate system of electrical testing, in order to prove that they are electrically sound, and are really insulators. In spite of all the precautions taken, however, bad insulators do show themselves on land lines. Whether they have escaped the searching tests or have become bad after being put up, such is the case, and a great loss of the electric current is due to the presence of bad insulators on a line—contributing to much bad working.

These defects have made themselves seriously felt on some of the Indian lines, where the insulators adopted are porcelain, protected with a galvanized iron cover; and in order to detect the faulty insulator without the necessity of removing it from a pole, the following plan has been arranged by Mr. Louis Schwendler, of the Indian Telegraph Department, and is presented in *Engineering:*

The principle of the plan is to produce a series of electromagnetic currents, pass them through the defective insula-



tor, and to measure these currents by the effect they produce upon the body of the person engaged in the testing operation. The annexed diagram will show the arrangement of the wires and the details of the test.

M is a small magneto electric machine connected from one pole by No. 1 wire on to the insulator to be tested, and from the other terminal to the upper part of the small key, K, and also to the platinum stud *f* in C. The lower part of the key is connected to the insulator bolt and bracket; by pressing the metallic key with its platinum stud *f'*, contact is broken between the points at *b*.

It is necessary that the wire No. 1 should be well insulated, so that no leakage beyond that due to the insulator itself can interfere; the No. 2 wire should also be well insulated. Before testing the insulator, it should be properly cleaned, and a temporary disconnection made between it and the line wire; this should of course be done before the connection in the diagram can be made.

If the handle of the magneto machine be turned and currents produced, it will be seen that, if there is any leakage through the insulator, the currents must pass through 1 and 2 wires, and by means of the contact at *b* and K back to the machine; the slightest pressure on *f'* will at once interrupt the circuit, but if the key, *f'*, be pressed by one finger, and the stud, *f*, in C, by another finger of the same hand, the circuit will again be closed through the hand. And if there be any leakage, the slight positive and negative currents due to that leakage (forming a circuit) will be felt as shocks from the machine, in a greater or less degree, according as the leakage is more or less. The amount of these shocks and, of course, the whole management of the test is in the hands of the one experimenter, who, while carefully feeling for the shocks with one hand, is with the other moderating the revolution of the machine to the requirements of the case.

It does not follow that, because no shocks are felt, the insulator is perfect. There is one more test which the experimenter can perform, but which should not be done until the finger test has failed. When such is the case, let one finger remain on *f* and touch *f'* with the tongue; if no shock be then felt, the insulator may be passed as perfect, as the electro-sensitiveness of the tongue may be considered as very great.

To give a practical test of the value of the finger and tongue when applied to such a purpose, Mr. Schwendler made some tests on some insulators (whose resistance had previously been accurately measured) using the currents produced from one of Siemens' magneto alphabetical instruments.

No. of insulator.	Resistance in Siemens' units.	Force of the magneto-electric currents across the insulators measured by the human body.
1	110	Strong shocks felt by the fingers.
2	130	" "
3	115	" "
4	190	" "
5	750	Slight shocks felt by the fingers.
6	2,300	Shocks no longer felt by the fingers, but strongly by the tongue.
7	5,700	The tongue no longer feels shocks, but a strong acid taste.
8	7,100	Taste of acid distinct, but slight.
9	8,200	" "
10	82,000	The tongue no longer feels any thing.

From the above experiments, it will be seen that, up to 1,000 Siemens' units, shocks may be felt by means of the fingers, and beyond that and up to 8,000 the loss of insulation can be detected with the tongue—an instrument which Mr. Schwendler considers the best for discovering faults of want of insulation, because it is sufficiently sensitive, never gets out of order, and, besides, is the least expensive instrument that one can employ.

Art Progress.

Dr. Dressler lately read a paper, before the Society of Arts, wherein he said:

One of the chief hindrances to the advancement of decorative art is to be found in the designers themselves, many of whom are ignorant and have no art ability; while others who have, often produce works which, though beautiful in form, are inconvenient in use and consequently calculated to bring art into disrepute. The fitness of the ornamentation of an article to the use for which it is designed is the end to which designers must educate themselves.

Certain manufacturers may truly be regarded as hindrances to art progress. It is curious that there are many men who would not rob another of a farthing, and yet who eagerly look for every new pattern which more honorable manufacturers than themselves produce, with the view of copying them if they be good and are not protected by registration, or of producing others as nearly like them as they can if they be registered.

Much has been said respecting the unwillingness of manufacturers to issue designs of an art character, and to pay such prices for patterns as will fairly compensate the designer for producing a carefully considered work. I have had as much to do with manufacturers, I think, as most artists, and I am bound to say that I have found most of them both willing to try new things and to pay handsomely for well considered designs; but the manufacturer cannot be expected to produce many patterns such as will not sell when placed on the manufactured article.

That class of the public who are pleased with whatever is "loud" and showy immediately hinder the progress of art, since some manufacturers will strive for the patronage of the most vulgar taste; but this hindrance will disappear with the increase of art knowledge.

Refrigeration by Means of Ammonia.

A Tellier refrigerating machine, just erected in the largest brewery in New Orleans, owned by George Merz, supplies the large storeroom, holding 5,000 barrels of ale and lager beer, with dry cold air at a temperature of 40°, the temperature outside being 85°. The refrigerating agent is liquefied ammoniacal gas, and to cool this large room but ten cubic feet of the material is required.

A large refrigerating cylinder, through which passes a number of pipes, is filled with the liquefied ammonia which vaporizes, rendering the pipes through which the air passes excessively cold. The ammoniacal vapor is subsequently compressed again into liquid form and returned to the cylinder to repeat the same operation without any waste of the material.

The Carré apparatus, another form of the ammoniacal ice and refrigerating devices, has been in use in New Orleans and Texas for several years with much success.

Dyeing Veneers.

It has been found that veneers soaked for twenty-four hours in a solution of caustic soda containing ten per cent of soda, and boiled therein for half an hour, may be, after washing them with sufficient water to remove the alkali, dyed throughout their mass. After being dyed, they must be dried between sheets of paper and pressed to keep their shape. It is stated that if, after the veneers have been treated in this way, they are left for twenty-four hours in a hot decoction of logwood (one part of logwood in three of water), then superficially dried and placed in a hot solution of copperas (one part of copperas to thirty of water they will in twenty-four hours be dyed a beautiful black.

A solution of one part of picric acid in sixty of water, with ammonia added until perceptible to the nose, dyes the veneers a yellow which is not affected by subsequent varnishing; and coralline dissolved in hot water, to which a little caustic soda and one fifth of its volume of soluble glass has been added, produces shades of rose color differing with the amount of coralline used.

The English Patent Laws.

The Select Parliamentary Committee on the Patent Laws have agreed to certain resolutions which they will recommend as the basis of legislation on the subject. They state that the privilege conferred by letters patent promotes the progress of manufactures by causing many important inventions to be introduced and developed more rapidly than would otherwise be the case; and it does not appear to them that the granting of pecuniary rewards could be substituted with advantage to the public interest for the temporary privilege conferred by letters patent. At the same time, the existing laws are defective and require improvement; and the Committee think that protection for a limited period, and dating back to the time at which it was applied for, should only be granted for an invention on its nature and particular points of novelty being clearly described in a provisional specification, and upon the report of a competent authority that such an invention, so far as can be ascertained by such authority, is new, and is a manufacture within the meaning of the law. They further consider that all letters patent should be subject to the condition that the manufacture should be carried on within the United Kingdom, and that it shall be carried into effective operation, within a reasonable time from the granting of the patent, by the patentee or his licencees.—*Pall Mall Gazette.*

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On the Heating of Steel.

We believe that overheating has condemned splendid steel more frequently than anything else. *"Make it well hot that it will work easier"* is a common saying, and sounds well in the shop; but when heating steel, don't follow the advice, for although it may seem to work easier when overheated, the error committed thereby will soon become apparent. All cast steel (excepting the comparatively new article, "chrome cast steel," which has properties entirely its own) requires the most careful heating. The fire must be regulated by the size of the work; and in heating the steel, heat the coals around the outside of the fire as soon as the flames begin to break out in order to prevent the heat from escaping. To save fuel, damp the coal and throw water on the fire if it extends beyond its proper limits.

To ascertain the heat of the steel, draw it out of the fire, and that often; for it requires to be well watched to heat it properly, and if not hot enough, thrust it in quickly again; but be careful not to use a higher degree of heat than is absolutely necessary to effect the desired purpose, and to use as few heats as possible. Steel is, essentially iron with a larger ingredient of carbon; therefore, too frequent heating or overheating burns out the carbon, and thus spoils its valuable character. Many smiths have the idea that so long as the steel does not fly to pieces when they strike it with the hammer, it is not too hot; but this is an erroneous idea, and easily proved when it comes to be hardened, and when it is brought into use. We therefore say again, that no forger can be too careful in the heating process, and when he takes the heats. The practical eye will soon learn when it is heated properly for forging. But few forgers will admit that they spoiled the work by overheating, and yet this is unfortunately most frequently the case.

ON THE WELDING OF CAST STEEL.—For welding cast steel, a flux is required in order to prevent oxidation of the surfaces to be joined. For this purpose, use a composition consisting of sixteen parts of borax and one of sal ammoniac, which has been boiled together over a slow fire for an hour, and when cold, ground into a powder. The steel is first heated a little, then dipped in the flux, and the heating continued until the metal has attained the proper heat. The flux is then fused over the surfaces, and has dissolved any oxide of iron which may have formed. The two surfaces to be joined are laid together and struck continuously, working toward the edges in order to expel the flux and insure a perfect union of the metal. Shear steel is joined to wrought iron without difficulty; but when cast steel is to be welded to wrought iron, the greatest care is required, or else no sound welding will be effected. By using the above mentioned flux, it can be done; but in all cases where steel is to be joined to iron, the steel—no matter what kind—should never be heated to so high a degree of temperature as the iron.—*The Hub.*

Secondary Batteries.

It is well known how the Leyden jar discharges, in one strong spark, the sum of electricity it received from the electric machine. M. Planté connects a somewhat analagous apparatus with the voltaic pile. Two plates of lead (20in. long by 8in. wide) are rolled up in spiral, being separated from each other by a few strips of india rubber. This spiral is placed in a jar containing acidulated water, and having a gutta percha cover, on which are fitted binding screws connected with the plates. Twenty such elements are placed in two rows of ten each, and charged from the primary battery, which consists of two Bunsen couples. By means of a commutator of peculiar construction, these secondary elements may be connected either for quantity or for intensity. When the elements are joined in series, an electromotive force equal to thirty Bunsens is obtained, giving a current by means of which platinum wire may be fused.

In the secondary couples, the chemical action generating the current is the reaction of hydrogen on peroxide of lead, the current from the primary pile, having caused decomposition of the water, oxidizing one of the plates and developing hydrogen on the other.

By the above arrangement, the quantity of electric work from the direct action of the primary pile is transformed by condensation. This case is somewhat similar to that of a hydraulic press or crane. In a pile driver, *e. g*, a heavy body, raised by degrees to a great hight by a series of successive efforts, is then left to itself, and gives back at once the greater part of the work thus expended on it. So, when, after charging, the secondary circuit is closed, the sum of the accumulated chemical actions caused by the primary current is given out in the form of a very intense current of short duration. The effect, when the couples are joined for quantity, corresponds to the fall of a very heavy mass raised a small hight; when joined for intensity, to the fall of a small mass raised to a great hight. It is not difficult to see how these secondary piles may become of important use.

The Mastodon Bones.

At a recent meeting of the Cornell Natural History Society, Mr. Seybolt read a paper on the skeleton of the mastodon lately exhumed on the farm of A. J. Mitchell, near Otisville, Orange county, N. Y. The facts of the case were drawn from the personal observation of the speaker, and were consequently listened to with much interest. The skeleton was discovered December last in a deep wet swamp. The bones found up to the 1st. of April were the ribs, vertebræ, head, pelvis, and bones of the forelegs, indeed all the bones except those of the hind legs, lower jaw and tusks, which undoubtedly will be found ere long. The head is of astonishing size and measures three feet seven inches across the top and over four feet in length. Of the teeth, the back tooth extends seven inches along the jaw and has a width of three inches. The tusk holes are seven inches in diameter and extend three feet into the head. The shoulder blades are each two feet in length and about the same in breadth. And the ribs, some thirty in number, measure in the longest between five and six feet. The pelvis bone, which was taken out entire, measures in its greatest extent five feet seven inches. The skeleton as a whole is supposed to be the largest yet discovered. When set up, it will be fourteen feet in hight and twenty-five feet in length. Twigs of coniferous trees, leaves and other vegetable matters were found between the ribs, and tufts of dun brown hair from two to seven inches in length were found outside. Concerning the deposits in which the skeleton was found, the upper layer, from five to fifteen inches in thickness, consisted of common black swamp dirt; beneath was a layer of coarse, fibrous peat quite dry in its character and varying from two to four and a half feet in thickness; below this was a stratum of coarse marl, a foot in thickness, then a curious layer of grass, matted and quite well preserved; then another layer of marl, below which appeared the clay which is supposed to underly the region roundabout. The bones were found chiefly in the lower strata, but a few occurred in the upper. The swamp is at the eastern base of the Shawangunk mountains, and the under stratum sloped eastward, disclosing sea washed cobble stones and marine shells. The bones are of a brownish color, being undoubtedly impregnated with oxide of iron. No disposition has yet been made of the skeleton, but it will be sold to the higheat bidder.—*Cornell Era.*

Adulterations.

While it is very difficult, and perhaps almost impossible, to detect the finer kinds of adulteration in the case of liquors, we are fortunately able to follow the adulterator of the ordinary articles of food, and to detect his practices with certainty. Add perfectly odorless spirit to brandy, and although the adulteration is notable and profitable, it is beyond the reach of the chemist. Add chicory to coffee, and although the chemist fails to point it out with certainty, the microscopist is not so easily balked. Before the searching power of this wonderful tube, the secret operations of the adulterator become as obvious as if performed in full view; for the microscope reveals to us the ultimate structure of the different vegetable and animal substances, and as each has its own well marked characteristics, it is as easily recognized by the expert as are the faces of his friends by an ordinary observer. No one who has ever seen potato starch could readily mistake it for anything else; chicory and coffee are so unlike that the difference is instantly perceived, and the smallest addition of either one to a sample of the other is readily detected. So, too, in regard to many sophistications of a purely chemical character. Red lead, added to vermilion, is easily separated; sulphuric acid, or oil of vitriol, when used for the purpose of increasing the strength of vinegar, is readily recognized; sugar, when adulterated with sand, may easily be made to give positive evidence of the presence of the latter; the coloring matter employed for the purpose of converting worthless tea leaves into the "best" green tea, may without difficulty be identified; and the mineral matter, such as *terra alba*, or farinaceous substances such as wheat, corn or potato starch, used for the purpose of increasing the bulk and weight of confectionery, may be determined. There is a wide range of cases in which adulterations may be detected with ease and proved with certainty. Some of the tricks of the wily adulterator show a marvellous ingenuity. Thus some persons, knowing that most ground coffee is adulterated, never buy the ground article, but always procure the whole beans, which they either grind themselves or get ground. To meet this case, the adulterator makes up a paste of ground chicory, pea flour, and other cheap materials, and molds it, by machinery, into the form of the beans. These artificial beans are rolled in a barrel until smooth, roasted to the proper color, and mixed with a small proportion of genuine beans, to give them the true coffee flavor. The fraud is of course easily detected, as such beans quickly fall to powder when soaked in water; but this example shows the ingenuity and painstaking of the fraudulent classes, who often spend, in efforts to cheat, an amount of labor and ingenuity that, if devoted to some honest undertaking, would be certain to insure success

Any attempts to suppress the practice of adulteration must be based upon certainty of exposure and punishment. How many children are robbed of their due amount of nutriment by the vile practice of watering milk? How often is the physician disappointed in the effects of the medicines that he prescribes, simply from the fact that these medicines are not pure, some dishonest and avaricious druggist having adulterated them with cheaper and less potent materials, in order that he might make a little gain?

We feel satisfied that the practice of adulteration will never be completely and permanently checked until the government takes the matter fairly in hand, and enacts efficient laws looking to the detection and punishment of this crime. —*Professor Phin, in Good Health.*

A SCHOOL house in Copenhagen, Denmark, is furnished for 1,000 children; one session is held in the morning, 1,000 attending, and a second in the afternoon, 1,000 attending, both schools being under the same general management. The system secures a happy union of bodily and mental exercise, the scholars working half the day.

A NEW tin tea kettle takes a longer time to boil than an old one, because the bright surface reflects or throws off the heat of the fire; but the old one, having a dark surface, absorbs the heat.

Improved Cooking Vessel.

For some time past, we have employed in our domestic establishment one of Warren's improved cooking vessels, and find it to be an important and valuable addition to the culinary service. It is, in fact, an automatic cook, and performs its allotted duty with a great deal better judgment and far less fuss than the best forty dollar-a-month French cook that ever officiated over a stew pan.

The patent cook consists of a series of combined vessels, and, in using it, you simply place your roast beef, steak, mutton, ham, fish or game and the various vegetables, each in its separate division, and set the vessel on the fire; where it remains for a specified time without any attention. It cannot burn, over do or under cook, but when the time is up, you have the finest cookery that can be imagined, executed on strictly scientific principles. That is to say, the cooking is done at a temperature of not over 210° Fah., which, according to Liebig, is the correct heat. A higher temperature coagulates the albumen and renders meats tough and stringy. This machine is not a steamer but a roaster; but you can make it a steamer, if desired, by shifting one or two of the covers.

By the ordinary methods of cooking, one third of the original weight of the meat is lost by the evaporation of the juices; but with this improved device this loss is to a great extent prevented, and the cooked food is greatly improved in quality. Made by the Newport Lead Works, Newport, R. I.

A Hint to Nurses.

You know what a racket is caused, even by the most careful hand, in supplying coals to a grate or stove, and how, when the performance is undertaken by the servant, it becomes almost distracting. If you don't remember, take notice the first time you are ill, or you have a dear patient in your care, or the baby is in a quiet slumber. Let some one bring on her coal scuttle or shovel, and revive your recollection. Well, the remedy we suggest is to put the coals in little paper bags, each holding about a shovelful. These can be laid quietly on the fire, and, as the paper ignites, the coals will softly settle in place. You may fill a coal scuttle or box with such parcels, ready for use. For a sick room, a nursery at night, or even for a library, the plan is admirable. Just try it. Besides, it is so cleanly. If you don't choose to provide yourself with paper bags, you can wrap the coals in pieces of newspaper at your leisure, and have them ready for use when occasion requires.

Preparation of Beet Leaves for Fodder.

Méhay maintains the entire success of his method of so preparing the leaves of the beet as to render them capable of preservation for several months as fodder, and at the same time greatly improving their qualities as food for cattle. The method consists simply in placing them in baskets and immersing them in a tank containing diluted hydrochloric acid of 4° of Beaumé. The result of this is to greatly condense the volume of the leaves, and to render it necessary to add more fresh ones to fill up the basket, which has to be again immersed, and finally allowed to drain off. The leaves may then be placed in beds, in dry earth, and kept until needed for use. According to a report of a committee who examined the results of this process, domestic animals become extremely fond of the leaves thus prepared; and, indeed, milch cows fed with them are said to give a large increase of milk, with a decided improvement in the quality of the butter. The tendency to diarrhœa in cattle produced by the fresh beet leaves seems not to be developed by this prepared fodder, and for this and many other reasons it is strongly recommended to agriculturists.

Source of Nitrogen in Plants.

It is well known that the quantity of nitrogen contained in the crops exceeds in enormous proportion that existing in the manures, the excess undoubtedly being derived from the air. It is now a question whether this is extracted directly from the air by plants, which would thus have the power of assimilating directly, or if it is first taken from the air by the soil, so as to combine with organic matter and form an assimilable compound. According to Deherain, oxygen, in the presence of organic matter, combines directly with nitrogen to form a compound analogous to the humus of the earth, or to ulmic acid. To illustrate this, he placed in a tube oxygen, nitrogen, glucose, and ammonia. On drying the tube and heating it, a black, nitrogenized matter was left, and a portion of the nitrogen in the tube was found to have disappeared.

REGULATING THE HATCHING OF SILKWORM EGGS.—Duclaux, after a careful observation of the external conditions which favor and influence the hatching of the eggs of silkworms, has prepared the following rules, by attention to which it is said that the development of the eggs can be regulated at will. First, to prevent an egg from being hatched at the usual time, it must be kept, from the period of being laid, at a temperature between 59° and 63° Fahr., and then exposed fourteen days to cold, three months before the time at which the hatching is desired, being subsequently treated in the usual manner. To cause an egg to hatch before the usual time, it must be exposed to cold twenty days after being laid, and kept in that condition for two months, and then removed. Six weeks later it will be in the same condition as ordinary eggs, and can be treated in the same manner. In this way it is possible to have silkworms ready for hatching at any season of the year.

THE actual duration of a flash of lightning does not exceed the millionth part of a second. But the retina of the human eye retains the impression of the electrical flash for a much longer period.

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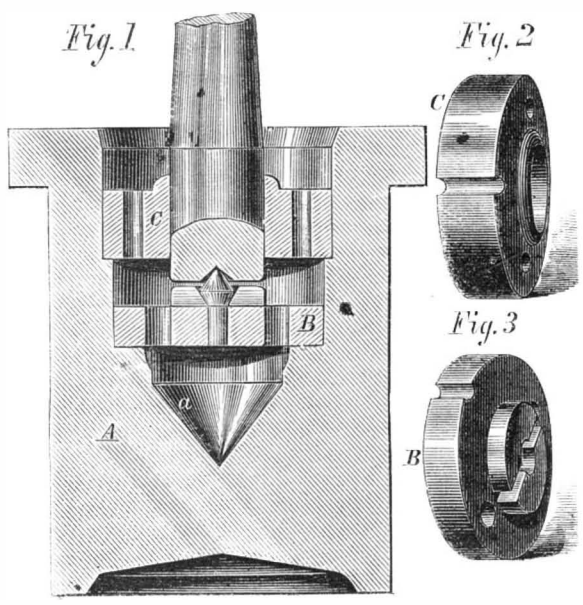
MILL STEP.

This invention furnishes a step for millstone spindles, or any vertical shaft running at a high rate of speed, which prevents the heating of the parts coming in frictional contact and protects them from cutting and wearing rough. Fig. 1 shows, partly in perspective and partly in section, the arrangement of the parts.

A is the box, which incloses and supports the other portions, and which is provided with the chamber, *a*. B (shown in perspective in Fig. 3) is the plate upon which the spindle or shaft rests; and C (shown in perspective in Fig. 2) is a ring encompassing the shaft. The plate, B, and the ring, C, will be observed to have holes through them, and they are each provided, as seen in Figs. 2 and 3, with a groove at the side by means of which they are keyed in position in the box. The plate, B, is grooved across its upper face. The spindle is steadied by a loose pin resting in a central hole through the step plate, as shown in Fig. 1. In operation, the oil used runs down through the holes in the ring and plate and fills the groove across the face of the latter, by which means the bearing is kept well lubricated and free from the action of



grit or dust, etc., all such substances passing through the holes into the chamber, *a*.

The invention was patented May 2, 1871. For further information address the inventor, Mr. Lewis Marsh, P. O. Box 1,579, Minneapolis, Minn.

Bone Setting.

Bone setting is not the art of resetting broken bones or dislocated joints; bone setters are not surgeons, or regular practitioners in any sense of the title; and their patients, even when they have suffered injury to joint or bone, have been pronounced by the regular practitioner cured before seeking the help of the bone setter.

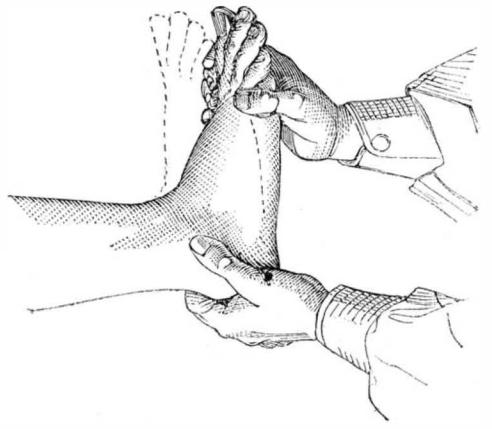
"A healthy man sustains a fracture of one or both bones of the fore arm, and applies at a hospital, where splints are adapted in the usual way. He is made an out patient, and the splints are occasionally taken off and replaced. After the lapse of a certain number of weeks, the fracture becomes firmly united, the splints are laid aside and the man is discharged as cured. He is still unable to use either his hand or his fore arm, but is assured his difficulty arises only from the stiffness incidental to long rest of them, and that it will soon disappear. Instead of disappearing, however, it rather increases, and in due time he seeks the aid of a bone setter.

The answer of the irregular practitioner, that is, the bone setter, is precisely the opposite, namely, that freedom can only be restored to the stiffened joint by movement, by manipulation, and manipulation too of the most formidable kind, nothing less than suddenly and forcibly rupturing and tearing asunder the adhesions formed between the articulating surfaces of the affected joint, an operation which is so frequently successful that it forms the very basis of the bone setting craft.

It is here that the bone setter steps in front of the scientific surgeon, and we must confess to a feeling of disappointment that their relative relations are not reversed, that the surgeon is not called in to rectify the malpractices of the quack instead of the latter being sought out to complete the shortcomings of the former. Let us see how this manipulation is performed. The bone setter has a clearly defined system of treatment for each separate joint, if not for each specific affection to which each joint is subject. One example may here be given:

"The proximal side of the affected joint being firmly held, and the thumb pressure made in the ordinary way, the tarsus is so grasped as to give the greatest attainable leverage, the foot twisted a little inwards or outwards, then sharply bent up upon the leg and again straightened. As a rule, it is desirable to execute this manœuvre twice over with an inward and once with an outward twist, and also to take care that the movements of the joint are free in all directions."

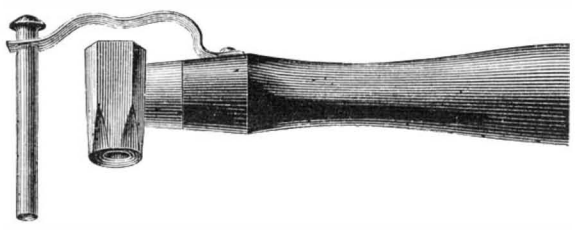
Bone setters, we are told, are for the most part uneducated men, wholly ignorant of anatomy and pathology; but we are not told what we greatly wish to know, and that is, the manner and method in which the secrets, the mysteries, and the traditions of their craft, are communicated to each other. No doubt there exists a freemasonry in the craft, so that when individual members meet revelations are made and notes compared, but we are not informed of any regular or organized system of instruction, either for the maintenance and extension of the craft, as a craft, or for the enlightenment of the separate and detached members of the fraternity. The most celebrated, we may even say distinguished,



bone setter of our day was the late Mr. Hutton, whose successful treatment of cases that had baffled the skill of the foremost surgeons now living (cases related in detail by Dr. Hood, and about the accuracy of which there can be no question or doubt) is little short of marvellous; and the question is ever recurrent while we read: "How and where was this skill acquired?" for a bone setter of Mr. Hutton's caliber could put his finger on the spot where lurked the seat of an affection that had crippled a patient for half a dozen years, and had defied the scientific treatment of the ablest surgeons of our time; nay, he could point to this spot without ever seeing the limb affected, guided merely by observing the attitude, gait, or action of the patient. Now, whence comes this undoubted skill of these illiterate men? It appears to be obtained solely by observation of symptoms and results of treatment, the accumulated knowledge of from day to day experience; and as we often see that one sense is quickened and functional power increased by the loss or impairment of some other sense, so perhaps the narrowing of the field of instruction, the limiting of the sources of information, may have intensified the powers of observation of the bone setters, atoning in a measure for the absence of the revelations of science.—*Nature.*

RIVETING DEVICE.

The annexed engraving represents a new tool for fastening copper rivets in leather, which appears to possess some merit. It will be seen from the cut to consist of a handle carrying a head somewhat resembling a hammer, and a punch or plunger attached to it, for security's sake, by a strap. The head has a cylindrical hole through it, the margin of which, at the lower side, is made slightly concave. The punch or plunger fits the hole in the head loosely.

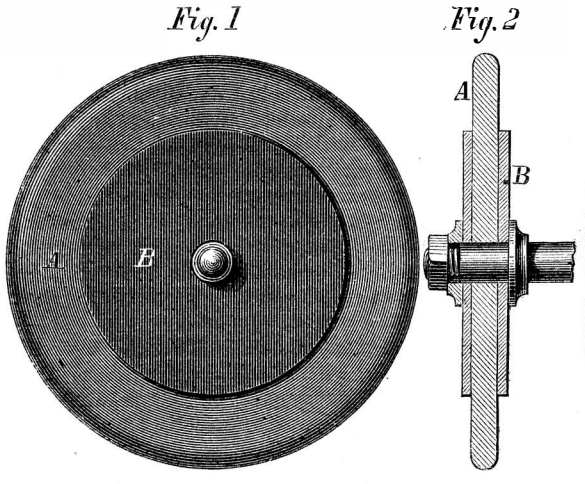


In using the tool, the rivet is put through the leather and the washer placed upon it; the head of the rivet is then laid upon some hard substance, and the lower side of the tool head placed upon the washer, in which position the end of the rivet enters the cylindrical hole. A blow upon the upper side of the tool head drives the washer down snugly upon the leather and draws the rivet head flat. The punch or plunger is then inserted in the hole, and a blow upon the upper end heads down the rivet evenly and smoothly.

Patented through the Scientific American Patent Agency, for the inventor, Mr. Thomas J. Allison, of Turnersburg, North Carolina, of whom further information may be obtained.

STRENGTHENING EMERY WHEELS.

The improvement illustrated in our engraving relates to



the construction of emery wheels which are used for the grinding and polishing of metals. It consists in the application of disks of rubber, leather, or other elastic or flexible material, to one or both sides of the emery wheel. Fig. 1 is a side view of the wheel, and Fig. 2 a vertical cross section of the same.

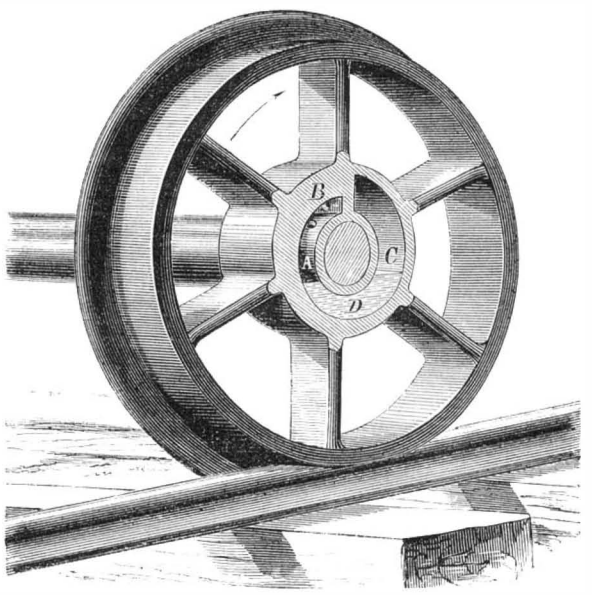
A is the emery wheel, and B is the disk of suitable material, which is made to adhere to the wheel by means of glue or other cement.

Thin emery wheels are in great danger of bursting if run at high speed, and, though very useful in the mechanic arts, are not used as often as they would be, or are run at low speed, on account of the risk attending them. The application of these disks strengthens the wheel and prevents its bursting when revolving at a high rate of speed.

Patented through the Scientific American Patent Agency, May 14, 1872, by Walter S. Jarboe. Further information may be obtained by addressing Union Stone Company, 29 Kilby street, Boston, Mass., or 93 Liberty street, New York.

PEART'S PATENT PIT CAR WHEEL.

Annexed we give a representation of this wheel, with the hub in section so as to show its interior arrangement. The object of the invention is to perfect the lubrication of the working parts. C is the oil reservoir, and D the oil placed in it. A is the hole to convey the oil to the shaft. B is a



spurt hole from one side of the reservoir to the other. On starting the revolution, the oil reaches the journal in sufficient quantity for lubrication, and the supply is stopped by the centrifugal force developed by the wheel when fully under way. The spurt hole, B, relieves the surplus oil on either side by allowing it to pass through. The wheel can also be used as a loose pulley; in which case the direction is as shown by the arrow, and the spurt hole, B, is closed. The advantages claimed are that thin oil can be used and no more of it consumed than absolutely needed; that it requires attention but once a month, and costs no more than other wheels.

Further information may be had of the Atlas Works, Thos. N. Miller, President, Pittsburgh, Pa., who states that the wheel is already used in forty coal mines.

DISCHARGING COAL.

A party of invited guests were recently united to witness the discharge of the barge *Dunderberg*, belonging to the American Coal Barge Company, at the yard of S. Tuttle, Son & Co., Brooklyn, N. Y.

The patent carrying vessels and method of discharge adopted by this company are novel, and greatly improve on the old system. The coal barges, which are 175 feet long, with a carrying capacity of 1,000 tuns, are divided into compartments called pockets. Every pair of pockets is provided with a well hole, over which is placed an improved elevator, so arranged that the coal is automatically fed from the pockets and carried rapidly by the elevator to a chute which in turn conveys it into a building on the wharf. This building, also called a pocket, is raised on posts sufficiently to admit the passage under it of a train of cars or other vehicles, which are loaded from above with great rapidity and convenience.

The old barges, which are about 200 tuns burden, are unloaded by means of buckets and an ordinary derrick, and are unable to discharge more than 25 tuns an hour. The company's barges carry five times this burden, and are discharged by their patent elevator at the rate of from 200 to 250 tuns per hour.

STEAM PROPULSION ON CANALS.

A correspondent, "Tennessee," takes exception to that portion of "Pro Bono's" letter on this subject, published on page 260 of the current volume of the SCIENTIFIC AMERICAN, wherein he stated that "no plan has yet been submitted which is capable of superseding the old system in point of economy." "Tennessee" quotes from the report of Mr. Green, who was engineer to the State Commission, to show the feasibility of carrying on canal navigation by steam with an economy which was altogether foreign to the old system; and he takes the ground that boats have already been designed by skillful inventors which are well calculated to answer all the conditions necessary to the attainment of that end.

THE evergreens at the Central Park, New York, such as the Norway spruce, hemlock, juniper and *arbor vitæ* were badly affected by the severe cold of the past winter. Hundreds of them were killed.

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EIGHT HOURS' WORK AND TEN HOURS' PAY.

For the past few weeks, the city of New York has been passing through a revolution which, though stamped with none of the acts of lawlessness which have too often characterized similar uprisings, is succeeding in effecting results which may produce important and material changes in the relations of capital and labor throughout the land. Organized bodies, representing nearly every industry in the city, have boldly, firmly, and earnestly demanded the enforcement of a law which is deemed necessary to protect the rights of the working man, to afford him opportunities now denied him for relaxation and self improvement, and to ameliorate a condition under which he chafes, and to which, it is claimed, he has been driven by the encroachments of capital. Questionable advantage, it is true, has been taken of a critical point of affairs. The employer with his yearly contracts uncompleted sees ruin staring him in the face in case of their non-fulfilment, and is consequently forced into acquiescence to demands which he would otherwise unhesitatingly reject. But even in face of this action, although it has doubtless engendered bitter feeling, we cannot but look with satisfaction on this comparatively peaceful revolution in contrast with the acts of atrocity which have rendered the methods of coercion, adopted by the Sheffield and other English organizations, a reproach on the whole system of trades' unions.

The unanimous movement of nearly our entire industrial population, numbering almost forty thousand souls, towards one fixed object must undoubtedly overcome all present opposition, but it remains a question as to what benefits will eventually be attained. To this, the answer can be found, not in the moment of excitement of the present, but in the future when the contest is over and the ordinary pursuits of every day life are in peaceful progress.

It is claimed that the working man when working ten hours per day has no time for recreation or self education, and that owing to the "magnificent distances" which he generally has to travel in this city to reach his place of work, his hours of rest are even further curtailed. Rapid transit will eventually obviate the last mentioned difficulty; but without animadversion on the laboring classes in general, it is but fair to ask who out of the great masses would devote their spare time to the acquirement of useful knowledge. The machinist, the carpenter, are the types of a class who would doubtless labor to perfect themselves in their several callings, but we hardly think it probable that the same would be the case with the large numbers who, without any special trades, are simply "day laborers." These men would be in idleness for a portion of the day and, being without resources or incentives for self improvement, would sink to a condition undeniably worse than that which they at present find burdensome. The record of those countries where the people are most idle shows them to be least advanced in industrial progress. Spain, where the laborer spends half his time sleeping like a dog in the sun, can hardly be compared with the nations of the North, where the artisan works his four "schofts," sixteen hours per day.

The question as to whether the condition of the workman will be bettered, or whether he will be in any measure released from the sway of capital through his working but eight hours per day, is in our opinion at best doubtful. In fact, it appears that the capitalist or the employer is actually, in the end, the gainer. It needs no great perceptive powers to see that, if a manufacturer pays, for eight hours' labor, the same sum that he formerly paid for ten hours, his manufacture will cost him more, and to make any gain he will be obliged to increase his prices. If this be true of large producers, it is equally true of small ones; the grocer, the butcher, all will follow, and the workman will discover that he will have to pay increased prices for his daily wants with precisely the same income that he had before the number of his working hours was lessened.

It might be suggested that he could devote his spare time to some labor whereby he could make up this deficiency. Even if he could so do, he would simply complete the circle, and find himself at the same point from which he started, with a poorer prospect of improving his condition than when he began; but the short sighted policy of the Unions forbids him. From the reports of late proceedings, we learn that the application of a well known manufacturer for permission to employ his men for over eight hours daily, coupled with an agreement to pay them extra compensation for extra time, was peremptorily refused. This we consider an assumption of power which is both illegal on the part of the Unions and unjust toward their several members. Not only does it embitter the feud between employers and employed, but it tends to destroy what seems to us as the fairest and most equitable method of settling the present difficulty and preventing its occurrence in the future. If every man worked by the hour, he could labor six or sixteen hours per day just as he chose; did he wish more time for self education, he would have but to take it; or, was he driven by poverty, extra work would enable him to attain independence.

We uphold the right of working men to associate and form Trades' Unions or Cooperative Societies as they think proper, but when they essay to restrict the right of every one to sell his labor to whoever will pay him most for it, to place the poorest work on a level with the best, or to dictate as to the amount of work which shall be performed in any space of time, we maintain that their action is both arbitrary and unjust, and that its tendency is only to defeat that cause which it should be their sole aim and endeavor to promote.

INFORMATION ON GUM COPAL.

As every day more uses for the resins and gums, of which copal is one of the most important, are discovered, and as a difference of opinion even exists in regard to its properties, one correspondent recommending to dissolve it in alcohol (question 7, page 233, and an answer on page 281), while another correspondent reports that he finds "that alcohol will not dissolve copal," it may be desirable to give some information in regard to this important substance.

It is unfortunate that no proper distinction is made between the use of the words *gums* and *resins*. We should like to confine the first name to all those vegetable exudations which are soluble in water, as gum arabic, gum tragacanth, etc.; while we would call resins those which are insoluble in water, but soluble either in alcohol, ether, turpentine, or their equivalents, as is the case with common resin, and thus not speak of gum copal, gum dammar, gum lac, gum elastic, etc., but call them resins. Some of these, however, consist of a mixture of a gum proper with a resin; such is the case with gambouge, assafœtida, and a few others; but the so-called gum copal is a true resin, insoluble in water.

There are four kinds in the trade. (1.) The Brazilian and West Indian copal; (2) the African and East Indian copal, collected chiefly in Madagascar and the neighboring region; (3) the North American copal; (4) the soft or false copal, which comes sometimes from Brazil, and is sometimes found mixed with the East Indian copal. Fossil copal, found in the clay at Highgate, near London, England, and in the auriferous alluvium at Bucarmanza, in the province of Soccore in New Granada, is also sometimes received from the East Indies, and is not to be confounded with the resin which flows from the copal trees on to the ground between the roots; and being very impure, full of earthy material, is sometimes also called fossil or mineral copal.

The copal as found in commerce consists usually of flat rough pieces of different shapes and sizes. The physical properties are by no means uniform, varying with its origin. Generally, the pieces are not clear outside, but inside clear and either nearly colorless, yellowish, or brownish, and including insects or parts of plants; sometimes the pieces are so dark colored as to be only slightly translucent. Their substance is quite hard, shows a very smooth and conchoid fracture, is easily pulverized, and does not stick together again, even when chewed. At 122° Fah. it becomes slightly soft. The specific gravity varies from 1·045 to 1·14, and it thus sinks always in water.

The properties of the different copals in regard to solvents are found to be very various, according to the origin; the American copal, for instance, is much less soluble in alcohol and oil of turpentine than the East Indian copal. But the copal takes oxygen from the air, or oxidizes, especially when pulverized and kept long in a dry, warm, airy place; and then it becomes much more soluble in alcohol and oil of turpentine. The solubility also increases by melting at as low a temperature as possible; but the American copal is more difficult to melt, becomes darker, and often remains after all so insoluble as to be totally unfit to make varnish of. Sometimes such copal may be dissolved when pulverized, or placed in a bag and exposed to the vapors of hot alcohol, when the soluble portions slowly dissolve out and drop in the liquid below; the previous solution of some camphor in the alcohol has been recommended. Unverdorben recommends to digest two parts copal with three parts of absolute alcohol for twenty-four hours; the insoluble portions will then dissolve in the concentrated solution of the soluble parts. But with some kinds of copal, this does not succeed. In ether, the copal swells up into a sirupy mass. Heating this and adding slowly small portions of hot alcohol of 0·82 specific gravity, a clear solution is obtained; if, however, the alcohol is added cold and at once, the copal precipitates, and can no more be dissolved.

Petroleum dissolves only one per cent of copal, turpentine a little more; two parts of copal form with one part of turpentine a thick fluid mass: and on adding more turpentine, the copal coagulates. The pulverized and oxidized or carefully melted copal dissolves more easily in other etherial oils. The best way is to melt the copal in a glass flask, at as low a temperature as possible, and to add gradually turpentine heated to 212° Fah.; if the latter be added too suddenly, the operation fails. Bisulphide of carbon dissolves copal only partially; oil of caoutchouc better, even without heat. Concentrated sulphuric and nitric acids dissolve the copal perfectly; but by a slight elevation of temperature, a decomposition and destruction takes place.

Alkaline solutions dissolve copal easily, by help of heat, and a peculiar aromatic flavor is perceived. However, such a solution cannot be used for varnish, as it becomes milky on cooling; even the clear gelatin, made by ammonia dissolved in alcohol, is a clear solution which becomes as white as chalk when dry.

Finally, chemical analysis has shown that copal consists of half a dozen or more resins, of different qualities mixed in different proportions, and which have been called after the letters of the Greek alphabet, *alpha* resin, *beta* resin, *gamma* resin, etc. They have been analyzed by Unverdorben and found to possess quite different properties in respect to composition, chemical and physical characteristics, solubility, etc. But none of the copal resins can produce succinic acid, as is the case with the amber, which is much like the copal, but is, as is well known, a fossil product of more uniform properties and easier solubility.

The so-called gum dammar is very much like copal, and is often sold for the same, and is even preferred for its greater solubility. The varnish is not so hard, however. It must be well dried, otherwise it gives no clear solution. The solution is easily performed in two to three parts of boiling turpentine, then diluted with thick turpentine or boiled linseed oil.

THE UNITED STATES SENATE ON COMPENSATION TO INVENTORS.

The United States Senate lately proceeded to the consideration of the House bill directing the Secretary of the Navy to pay to R. M. Green the sum of $10,000, as payment in full for the use by the Government of his patent machine for bending chain cable links and connecting shackles, and tackle hooks.

Mr. Cragin stated that a board of officers had examined into the matter and had estimated that the use of the machine in question in the Washington navy yard, where Green is a mechanic, had saved the Government during the last four years $40,000 in labor alone. He thought the sum proposed very small, as the board had reported the machine as worth $50,000.

Mr. Logan wished the bill amended so as to purchase the patent itself, and not merely the use of the machine. He said the universal practice in the Government navy yards, which he did not justify, however, had been to require mechanics to assign the use of their patents to the Government for the consideration of one dollar. Army and navy officers were not entitled to a royalty from the Government for any invention or patent of their's. He considered this bill violated this general principle, and that the sale of the patent itself should be made absolute if the money were appropriated.

Mr. Ferry, of Michigan, said it was well known that the mechanics, who are taxing their brains by inventions for the benefit of the Government while in its employ, are paid only the wages of daily labor, and if they were treated in the way described there would be no stimulus to them to try to economize either time or money. He believed the just course would be to fix a fair, moderate compensation to the mechanic, that he might be stimulated to invention.

The further consideration of the bill was postponed.

The bill authorizing a settlement of the claims made by the estate of the late Rear Admiral Dahlgren was afterwards taken up, and read a second time.

This bill proposes to refer the claim of the Admiral's widow, who administers to his estate, to the Court of Claims, whose duty it shall be to hear and determine: first, whether Admiral Dahlgren was the original inventor of the Dahlgren gun and projectiles described in his several patents, and, second, what amount of compensation, if any, his estate is justly entitled to receive for the use of his inventions and patents, and for a full and entire transfer of the latter to the United States. In determining the amount, the court is to take into consideration the facts that, while Dahlgren was engaged in perfecting the inventions for which the patents were granted, he was an officer in the United States Navy, and his time, services, and skill were due to the United States, who paid the expenses of the experiments, etc., made by him.

Mr. Stockton thought that if this bill had been drawn with the express view of meeting the objections made by the Senator from Illinois in the previous case, it could not more perfectly have done so. He thought every difficulty

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made by the Senator to the other bill was obviated. It was quite impossible for the Senate committee to fix the sum, supposing Admiral Dahlgren's estate was entitled to compensation, and he could see no means of adjudicating in the matter better than referring it to the Court of Claims.

Mr. Logan said the mere reference of the matter to the Court of Claims would be an admission by the Government that it owed something, and that the Court was referred to to ascertain the amount. They would thereby establish the principle that the use of every invention used by the Government must be paid for. The Dahlgren gun is a good one, it was true; but the fact that it was used in the army and navy to-day did not justify them in paying an amount of money for it, if it were done in violation of a principle that the Government ought to establish. This principle was that where officers in the employ of the government, drawing a salary, devote their time to perfecting inventions, the invention ought to be the property of Government. All his remarks, he said, were made in order to record his protest against the establishment of a wrong principle which would eventually cost the Government millions of dollars.

On the suggestion of Mr. Windham, the Secretary read from an opinion by Judge Holt on a decision given by the Chief of Ordnance, General Dyer, wherein the General took the view held by Senator Logan. The opinion stated "that no precedent has been discovered in which the 'principle' understood by General Dyer to be an 'admitted' one has been in any manner acknowledged. On the contrary, there are believed to have been repeated instances in which the opposite view has been taken by the Government."

Mr. Sherman thought no one could question the fact that Admiral Dahlgren had a property right in the use of his invention. When the government granted a patent, it recognized an existing property right in the patentee for a certain invention, and it had no more right to appropriate that property right than any individual had.

The bill was reported to the Senate without amendment, and ordered to be read the third time.

THE SEWING MACHINE RING IN A NEW ROLE.

The application, made to Congress by the Sewing Machine Ring for the revival of the expired Wilson patent, has utterly failed and the case has been withdrawn. But the same parties have put in another appearance, fully determined to obtain an extension of their monopoly in some shape or other. They have now applied, as the assignees, for the revival of the old Akins and Felthousen patent, which was originally granted Aug. 5th, 1851 for fourteen years, and then extended for seven years. This extended term ends on the 5th of August, 1872, when the patent becomes the property of the public, unless Congress interferes by a special act for its further extension.

The Akins and Felthousen machine, as originally patented, was a crude device, widely different from the present mechanisms. But by reissue, with claims unfairly broadened, and by act of Congress, the assignees hope to be enabled to prevent all other sewing machine inventors and manufacturers from producing their goods. They anticipate that the public will thus be compelled to continue to buy sewing machines, of the Ring exclusively, at exorbitant rates.

In our previous discussions of the sewing machine business, we have shown how gigantic is the monopoly now wielded by the small clique known as the Sewing Machine Ring; how they oppress our poor working people by charging them from forty to sixty dollars for the same sewing machines that they sell, at a great profit, for half the money on the other side of the Atlantic, where they enjoy no patent monopoly; and how they have always opposed other makers and inventors of improved machines, by refusing to grant them licenses on reasonable terms. It is needless for us to go over these charges again. Their general correctness remains undisputed, and they apply with equal force to the Akins and Felthousen case as to the Wilson patent and the other patents controlled by the Ring.

The public is tired of the exactions of these sewing machine monopolists. They have grown immensely wealthy; they have reaped the richest rewards for whatever they have done in developing the business. We earnestly hope that Congress will turn a deaf ear to this new petition, and let the sewing machine monopoly die a natural death.

Fatal Boiler Explosions.

The boiler of the *Epsilon* tug boat exploded at the foot of Burling Slip, East River, New York, at half past one p. m., on Monday, May 27. The captain and fireman were killed; the boat was totally destroyed, the fragments being scattered over the adjacent streets. Several minor casualties occurred from the disaster. It is stated that the boiler was in good repair, having been recently examined and tested.

A new boiler at Philadelphia exploded on the same day, causing one immediate death and fatally wounding one person, besides injuring five others. The engineer was the man killed, and we are informed that he had *chained down the safety valve* to get up steam. Mr. L. Phleger, the well known boiler inventor, discovered the criminal act, and was removing the chain when the explosion occurred. Mr. Phleger escaped uninjured.

AN extensive coal bed of remarkable depth and excellent quality has been struck near Raus, at Schonen, Sweden. At a depth of 566 feet, eleven strata of coal had indeed been pierced, but none of these exceeded in depth 1¼ feet. Five feet farther down, however, a bed was struck with a thickness of 8½ feet. The borings have been continued, and are believed to prove satisfactorily the existence of an extensive coal bed.

SCREW ELEVATORS.

One of the earliest and probably the safest form of hotel or passenger elevators ever introduced was the screw elevator invented by the late Mr. Tufts of Massachusetts. It consists of a large revolving screw standing in the center of the hoistway and reaching from top to bottom of the building. To the elevator platform is attached a nut, which fits the screw, and the revolutions of the latter carry the platform up and down with great regularity and perfect safety, the platform being in fact a part of the nut. No lifting ropes are employed, and passengers riding upon the machine, if they understand its construction, enjoy a sense of security which they never can have when they trust their lives to suspension ropes and safety clutches.

In view of these considerations, it is with regret that we learn that the proprietors of the Fifth Avenue hotel in this city have determined to remove the excellent screw elevator, that has served their guests with so much safety and success for many years, for the purpose of putting in a more recent patent suspension rope elevator. We shall miss a good old friend when the screw is gone. It is a noble piece of mechanism, and we always admired its massive proportions and stately movements. It is still in splendid order, capable of useful service for a hundred years to come, and whoever obtains it will possess an enduring and effective machine. It is true that the screw elevator obstructs the platform and moves a little slow. But for passenger use *safety* is the first consideration; roominess of the platform and speed come second. The Continental hotel, Philadelphia, is provided with a screw elevator, the counterpart of the Fifth avenue machine.

The Vienna Exposition of 1873.

The Archduke Rainer, President of the commission for preparing the necessary arrangements for the Exposition of 1873, has, in a circular dated March 20, 1872, made known that the owners of the beet sugar factories and sugar beet farms of Austria have authorized him to offer the following prizes for the best cultivators and machinery for harvesting sugar beets:

1. 1,000 and 500 dollars respectively for the two best beet sowing machines.
2. 250 dollars for the best harrow or land roller.
3. 50 dollars for the best beet weeder.
4. 500 and 250 dollars respectively for the two best beet cultivators.
5. 1,500 and 1,000 dollars respectively for the two best beet harvesters.
6. 100 dollars for the best beet cleaning machine.
7. 100 dollars for the best hoe.
8. 150 dollars for the best tool for raising the roots out of the ground.

All machines and tools competing for these prizes have to be delivered at the grounds of the Exposition prior to the month of March, 1873, excepting the harvesting machines which will be accepted as late as September, 1873. All machines and tools will be practically tried on fields of beet roots and in all kinds of soil, unless specially intended for certain qualities of soil and so specified. Awards will be made not later than November, 1873, but only for machines found to be entirely new and fully answering the purposes for which they are intended.

As regards other machinery intended for the Exposition from foreign countries, information is given that all working machines should be announced at Vienna prior to August 1, 1872.

The Inventor of Puddled Steel.

Anton Lohage, the inventor of puddled or wrought steel, died on April 21st, at Unna, in Westphalia. Being the son of a poor peasant, he was sent to an elementary school, and when twelve years of age, he entered the service of a richer peasant as sow herd, and passed through all the stages of an agricultural laborer. When twenty-one years old, he went to work at a factory, and developed there such skill and capacity that he was sent for two years to the factory school at Hagen, where Director Grothe improved him so much that he could be sent with advantage to the Polytechnic School of Berlin, where he studied for three years, and supported himself, partly by a small purse which was granted him, partly by working as a chemist in a factory. In 1848, he began his trials at the Haspe Iron Works, near Hagen, in Westphalia, and after some time he succeeded in producing steel of good and uniform quality by the ordinary puddling process. His invention was patented, 1850, in England by Ewald Riepe, and introduced at Low Moor; but owing to the quality of the pig iron, its use was very limited in England until, in 1858, Mr. William Clay introduced the process on a large scale at the Mersey Steel and Iron Works, Liverpool. In Germany, about 100,000 tons of puddled steel are made every year, and it forms the principal material for Krupp's celebrated cast steel.

FIREPROOF BUILDINGS.—If you will have wood floors and stairs, lay a flooring of the thickest sheet iron over the joists, and your wood upon that, and sheath the stairs with the same material. A floor will not burn without a supply of air under it. Throw a dry board upon a flat pavement, and kindle it as it lies if you can. Prevent drafts, and, though there will be fires, no houses will be consumed.

YEDDO, the capital of Japan, has lately suffered by a great conflagration. Five thousand buildings were burned, comprising 17 large government offices, 60 temples, 287 smaller government offices, and 4,753 dwellings, shops, etc. 20,000 people were rendered homeless. It is to be hoped that the Emperor will now order some steam fire engines.

Alloys of Copper and Zinc.

These two metals will mix with each other in all proportions. The color of the alloy varies with the proportion of zinc present, from almost copper red to zinc white. The alloys are made by mixing granulated copper and zinc in proper amounts, placing the mixture in black lead or Hessian crucibles, and putting these in a suitable furnace. The alloy must be removed as soon as melted, since by exposure to a high temperature it loses zinc.

Several of these alloys have received distinctive names. Pinchbeck contains 6 or 7 parts of zinc to 94 or 93 parts of copper. It has a reddish color, resembling red gold, and was formerly much used for watches and jewelry. When pale gold became fashionable, the alloy was also changed and it was called oroide; this consists of 10 parts of zinc to 90 of copper. Another alloy which is frequently used as a base for gilded articles is called tombac, and contains from 20 to 30 parts of zinc, and 70 to 80 of copper. Dutch gold, which is used for imitation of gilding, is composed of 14 parts of zinc and 86 of copper. This is malleable, and can be hammered into very thin sheets.

Brass contains 33·3 parts of zinc, to 66·7 parts of copper, varying, however, somewhat from those proportions according to the use that is to be made of it. It has several advantages over pure copper, besides being cheaper. It is much easier to work in the lathe, being harder and not so tough. It will also make perfect castings, which are hard to obtain from pure copper. A little lead is frequently added to brass, as it is not so tough and does not clog the file when containing about one per cent of this metal. Prince metal and mosaic gold are of the same composition as brass.

Ormolu contains equal parts of copper and zinc. Muntz or yellow metal differs from other brass in that it may be rolled when hot; it contains 40 parts of zinc to sixty of copper. The ordinary hard solder for brass may be made by melting two parts of brass with one of zinc.

Sterro metal contains, besides copper and zinc, a little tin and iron; it is very hard and has been proposed as a substitute for yellow metal in sheathing ships. Mallet's brass, which is used for protecting iron from oxidation, contains 25·4 parts of copper to 74·6 of zinc.

A Fowl Obstruction.

A late number of the Des Moines (Iowa) *Register* says: "A singular case of railroad obstruction, and one for which no remedy is provided by the statutes, occurred a few evenings since on the Valley road in Green county. Conductor Livingston's train, when about three miles this side of Grand Junction, in passing through some low country and near a pond, ran into an immense flock of swan, brandt, geese, and other wild fowl. The birds were just about to alight on the track as the train drew near. Their number was so great that the sky was filled with them, and those above pressing down on the lower strata forced them to alight on the car tops. The engine, tender and cars were covered with the fowls, and some even clung to the bars of the cowcatcher. One stately swan had a wing injured in the crush, and then found a resting place on the engine head light, whence he was taken by the engineer. The bird, however, managed to escape from custody near Perry, and jumping from the tender where he had been tied, disappeared in the grass. The raid continued several minutes, quite a number of the aerial army being run over by the train, and some half dozen being captured by passengers and train men. As soon as the birds on top of the flock began to understand the situation, they soared away, followed by the entire covey. Livingston says it was the biggest crowd of dead-heads that ever tried to board his train."

GOOD WOODS.—Do not be above your business, no matter what that calling may be, but strive to be the best in that line. He who turns up his nose at his work quarrels with his bread and butter. He is a poor smith who quarrels with his own sparks; there is no shame about any honest calling; don't be afraid of soiling your hands; there is plenty of soap to be had. All trades are good to traders. Above all things avoid laziness. There is plenty to do in this world for every pair of hands, and we must so work that the world will be richer because of our having lived in it.

SHOW me the person who complains of mental weariness, and I will find in him a torpid liver, obstructed kidneys, a dyspeptic stomach, constipated bowels, or an inactive skin. If the brain worker does not sleep enough, nor exercise enough, nor eat enough, or if he eats too much, or takes improper food, his digestive organs run down, and the clockwork of the brain, having no way to reconstruct the machinery through which it receives impressions and transmits volitions and impulses, is obliged to cease work.

The moral is, in brief, keep the body in health, and the brain will take care of itself, work it all you can.—*Dr. Trall.*

THE corporate authorities of Boston have decided to fill up that large portion of useless harbor mud known as the South Boston Flats. Seven hundred acres of valuable land will thus be reclaimed and added to the taxable property of the city, to say nothing of the augmentation of business and business facilities which will attend the consummation of the improvement.

TO light the streets of London, 630,000 gas lights are employed, which consume every twenty-four hours 22,270,000 cubic feet of gas; and if the streets of the metropolis were put together, they would extend a distance of about 4,000 miles.

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The Nes Silicon Steel.

Considerable interest has lately been excited by the announcement that a new manner of making steel has been discovered, which, on account of its cheapness and simplicity is likely to cause some great changes in the steel and iron business of this country. This new article is called "Silicon Steel;" and it is claimed for it that it is an entirely new product, differing very materially from any steel heretofore known to commerce. Dr. Charles M. Nes is the discoverer of the remarkable properties of the silicon ore used in the manufacture of this new steel, and the circumstances of his discovery are so romantic that we quote the following account from the *Rome Sentinel* of Jan. 9th:

Dr. Chas. M. Nes, a prominent practicing physician of York, Pa., being called to see a lady who had been struck by lightning, was led to investigate the cause of the attraction of electricity to that particular spot, and found by examination that the electricity had passed down the chimney, thence to a corner of the room where stood a double barreled shot gun, which it had melted down, thence out in the yard to the dog kennel, striking and melting the iron chains with which the dog was secured, and killing him. On examining the melted metal, the doctor was astonished to see the perfect purification and crystalization which had taken place, and conceived the idea of making steel by subjecting the iron while in a molten state to currents of electricity. While thus experimenting, with good results, he was one day hunting on a range of rounded, sloping hills on the Codorous Creek. He shot a pheasant, and stooping to pick it up, discovered a small piece of ore resembling in appearance the melted gun barrel and chain, having the same crystalization and purification. The similarity was so marked that he was led to examine and test its qualities, which he found highly magnetic. He melted some of the ore in a crucible, and ran out a button of very fine steel, which, on being analyzed, was found to be silicon steel, an entirely new product in the steel line, from which the ore derived its name of "Silicon Steel Ore." This led to other and more important experiments, among which was the puddling of 15 or 20 per cent of this ore with common pig iron, in an ordinary puddling furnace. It was surprising to find, as the result, an excellent quality of silicon steel. From that time to the present, he, together with several other scientific and practical men, has thoroughly investigated the whole subject, until it has become clearly and unmistakably established that the mixture of this silicon ore with common iron will produce a quality of steel superior to any in the known world, and at an expense only a trifle above ordinary iron.

Having read the above and some other accounts of the discovery of Dr. Nes, we went a few days ago, to Rome, N. Y., where "The Nes Silicon Steel Co." have established the manufacture of the steel for the express purpose of exhibiting the process, and spent several hours in examining the works and methods. Mr. E. Gulick, the manager, extended to us every facility in his power for informing ourselves, and gave us samples of the ore and manufactured products.

The process of working is briefly this: The silicon ore is first crushed into a coarse powder, then put through a refining furnace, where it is melted and run off into plates of hard metal an inch or two in thickness. Then certain proportions of this hard metal are put into an ordinary puddling furnace with common pig iron, and the whole melted. The silicon makes a very excellent flux in itself, and when this mixture has cooked long enough it "balls up," and is hammered into short square "blooms" under a steam hammer. By using from 3 to 8 per cent of silicon ore with common pig, the iron is merely purified; but if the silicon ore is increased to 15 or 20 per cent, the product is found to be steel of good quality. The "blooms" from the steam hammer can be rolled or hammered into any desired shape. The simplicity of the process is really astonishing. You have but to melt up your materials in certain proportions in any furnace, crucible, or pot you choose, and hammer out a good steel product. None of the expensive special fixtures required in making other steels are needed in making the "Silicon."

We brought home a sample of the refined iron made by this process, and also a piece of the steel. The iron (1 in. diameter, round) we bent double when cold without making a crack on the outside of the bend. It has a fine grain and finishes nicely. Of the steel, we made a "cold chisel." It tempered well, and holds its edge very well indeed. We shall test it further as to its fitness for springs, fine tools, etc. One peculiar property claimed for this steel is that, when polished, it will not rust. The silicon steel has already been tried as a cap to rails. There are said to be now ten thousand tuns of these rails in use on the Erie railway, and thus far with good results. Although the discovery and its consequent enterprises are too young yet to have determined their real worth compared with the old methods, still we are favorably impressed by it and have considerable faith that it will help us in the future.—*Oneida Circular.*

NEW VARIETY OF CUCUMBER.—In *Land and Water* we have a figure and description of what is called the new white spine cucumber. This, when raised on a trellis, grows to an enormous size, one vine having three specimens, each of them three feet in length, besides many others over two feet long. The flesh is said to be very solid, with but few seeds, and the flavor very fine. This method of growing cucumbers is recommended as furnishing a much superior result to that of allowing them to trail on the ground, as they thus grow finer, straighter, and with a larger yield. This new cucumber has the skin perfectly smooth. It is very short in the neck, and it is considered a decided gain to the resources of the vegetable gardener.

Krigar's Cupola Furnace.

Smelting iron in a cupola furnace appears to most people, who see it daily done at every foundery, the simplest thing in the world; it is, however, not so, if due regard is taken to economy and good quality in casting. In a common cylindrical cupola, three essential parts may be distinguished. The upper half or body of the furnace prepares the pig iron and lime which, together with coke, are thrown in at the top for smelting in the middle part or crucible, which is somewhat narrower and provided with numerous nozzles for the introduction of blast, whence the molten iron, together with slag, runs down to the lower part, or hearth, where it collects until it is tapped. When such a furnace is to be started, it is filled to about two thirds with coke and one third with coke and iron; fire is then introduced and the blast turned on, when the molten iron collects in the hearth and replaces the coke of the same. Here it necessarily takes up impurities from the coke and impregnates the latter so much that it cannot be destroyed by the blast; and when the iron is tapped, masses of coke and half melted iron, which are not any longer supported, tumble down in the hearth where they are imperfectly burnt or melted, and cause the iron which collects there to become cold and sticky. These irregularities take place after every tap, and it generally happens that iron, which was at first fluid and gray, suddenly becomes thick and white, and unsuitable for the castings intended. In order to avoid this, Henry Krigar, of Berlin, constructs his cupola so that the lower part, or hearth, is not below the crucible, but by its side, and connected with it by a slanting canal, which is about 3 in. high, 6 to 8 in. long, and as wide as the cupola. This arrangement prevents any coke or half melted iron from falling down in the hearth, which is only accessible to melted iron and slag, and forms for them a kind of sump or receiver, which in no way interferes with the regular working of the two upper parts of the cupola. This very simple construction has proved highly successful, and its great advantages are a saving of fuel, a uniformly hot and liquid iron, and an increased yield per diem, as the regular smelting operation is never interrupted. Kregar's cupola can, therefore, be recommended not only to founderies, but also to Bessemer works, and to such forges as use the Danks puddling furnace with liquid iron, as a uniform heat and quality of each charge are essential for their success.—*Engineering.*

Carbonic Acid.

It is often stated as one of the wonders of plant life, that plants are ablo to do what the chemist has failed to do, that is, to decompose carbonic acid.

While it is extremely difficult to decompose carbonic acid, completely separating it into carbon and oxygen, nevertheless it is quite easy to partially decompose it. If we pass a stream of the gas through a tube containing red hot coals, the coals are burnt at the expense of half the oxygen contained in the carbonic acid, and carbonic oxide is the result. Hydrogen, iron, and zinc act similarly towards it, abstracting half its oxygen.

Potassium burns in it with a red light, producing carbon and carbonate of potassium. This experiment may very readily be shown to a class by taking a tube about three fourths of an inch in diameter and ten inches long, bent at right angles near the upper end, which is sealed in the lamp. A piece of potassium about the size of a pea is introduced into the tube, which has been previously filled with dry carbonic acid over mercury, as all aqueous vapors must be avoided; by inverting the tube, the potassium is lodged in the upper end of the bent portion. If it is now heated by a lamp, the first action is to expel a portion of the carbonic acid from the tube; as soon, however, as the potassium approaches a red heat, it takes fire and burns vividly, completely absorbing the carbonic acid, if it is present in sufficient quantity. Sodium also decomposes carbonic acid, but without taking fire. In the presence of the alkalies at red heat, phosphorus and boron have the same action.

Canned Fruits.

The impression prevails among those who use freely fruits which are put up in tin cans, that they are injured thereby, and this impression is in many cases correct. We have long contended that all preserved fruits and vegetables should be stored in glass, and that no metal of any kind should be brought in contact with them. All fruits contain more or less of vegetable acids, and others that are highly corrosive are often formed by fermentation, and the metallic vessels are considerably acted upon. Tin cans are held together by solder, an alloy into which lead enters largely. This metal is easily corroded by vegetable acids, and poisonous salts are formed. Undoubtedly many persons are greatly injured by eating tomatoes, peaches, etc., which have been placed in tin cans, and we advise all our friends who contemplate putting up fruits the present summer to use only glass jars for the purpose.—*Boston Journal of Chemistry.*

INFLUENCE OF FOOD UPON POULTRY AND EGGS.—The influence of the food of poultry upon the quality and flavor of their flesh and eggs has not generally been taken into consideration; but it is now well ascertained that great care should be exercised in regard to this matter. In some instances, it has been attempted to feed poultry on a large scale in France on horseflesh, and, although they devour this substance, very greedily, it has been found to give them a very unpleasant savor. The best fattening material for chickens is said to be Indian cornmeal and milk; and certain large poultry establishments in France use this entirely, to the advantage both of the flesh and of the eggs.

Official List of Patents.

In consequence of the holiday at the Patent Office on Decoration Day, the list of patents dated May 28th, had not reached us at time of going to press. It will appear in our next issue.

TIN IN NEW SOUTH WALES.—Tin has been discovered in the northern portion of New South Wales. The localities in which deposits have been discovered are at present confined to the Macintyre river, where deposits of ore, mixed with alluvium and of stream tin, have been struck over an area of 10 miles by 12, and to the Oban district, on the first fall from the high table land of New England down to the Clarence river. In the latter locality, it has been almost exclusively stream tin which has been hit upon.

TELEGRAPH BETWEEN SCOTLAND AND CANADA *viâ* ICELAND.—The Danish war steamer *Fylla*, which sailed some days ago from Copenhagen for the Faroe Islands and Iceland, has been ordered by the Danish Government to take soundings and survey landing places for the submarine telegraph line intended to connect Scotland, *viâ* those islands, with Canada.

ERRATUM.—On page 322, current volume (No. 21), we described the proprietor of Motz' expansive pivot as Michael M. Motz, Woodward, Center county, Pa. It should be Mitchell & Motz, at the same address.

A Big Victory for the New Wilson Under-Feed Sewing Machine.—It will delight all the many friends of the Wilson Improved Sewing Machine to know that in the stubborn contest for superiority in samples of work at the Great Northern Ohio Fair, their favorite has carried off the two great premiums, the medal for best six specimens machine work, and the diploma for best specimen embroidery. As the great competition was in these two classes, it will be seen that the Wilson's victory is complete. We knew this would be so. It could not be otherwise. There is no talking down the fact that the Wilson is the best family sewing machine now manufactured, the one capable of doing the best work on any kind of goods and under all circumstances. This award of the highest premium to the work of the Wilson Improved Machine, should and will silence the talk of that large class of sewing machine men who have made this machine the object of their special enmity, simply because it is a moderate price machine and undersells their expensive ones. Go and see the first premium cards on those beautiful samples of work, and remember that you can buy this premium sewing machine for fifty dollars.—*From the Cleveland Herald.* Salesroom, 707 Broadway, New York; also for sale in all other cities in the United States.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—RECOVERING SILVER FROM WASTE SOLUTIONS.—I wish to know a practical method of reclaiming the silver from photographers waste, which consists of paper and the water from washings. I want to get it so that I can convert it into the nitrate.—C. O.

2.—TAPER STEEL RODS.—Will some one tell me the best and cheapest way to make round tapering spring steel rods, three feet long, diameters at ends three thirty-seconds and six thirty-seconds of an inch?—A. B. K.

3.—LIQUID FUEL.—Is there any kind of liquid fuel in use, by which I could make steam for a two horse engine?—J. B.

4.—ECCENTRIC WHISKERS.—What is the cause, or what will prevent, whiskers breaking off where they appear to eat through and turn white at the ends as if they had been singed?—A. S. R.

5.—PHOSPHORESCENT OIL.—Will some one inform me if there is any means of rendering oil or any other fluid permanently and continuously phosphorescent, if it is, at the same time, sealed air tight? If the phosphorescence would continue six months or a year, it would answer my purpose; but it must not require agitation or a heat of above 95° Fahr. to produce it.—H. W. B.

6.—PROPAGATION OF ROSES.—Will some one inform me if, by taking a hardy rose bush and budding other hardy varieties to it, it will prove a success? I should like to know how it is done, and the best time to do it.—B.

7.—MITRAILLEUR.—In Luttrell's "Diary," under date January 1690, mention is made of an expedition being fitted out against Ireland, and amongst the munitions taken are "four of the new invented wheel engines which discharge 150 musquet balls at once, and, turning the wheel, as many more; they are very serviceable to guard a passe." Does history repeat itself in this instance, and is this the forerunner of the Gatling and mitrailleur guns of all kinds?—S.

8.—CONDENSER WITH RHUMKORFF COIL.—How is a condenser connected with a Rhumkorff coil? As I understand it, I connected the opposite coats of the condenser with the opposite sides of the contact breaker. It increases the spark, but I cannot keep the break working. It will stop after a few vibrations and requires an impulse with the finger to start it and soon stops again. When the condenser is not connected, the brake operates perfectly. The contact points are tipped with platinum. I tried gold tips with the same success. The coil I made myself. I use five or six Grove's cells for battery.—S. G. S.

9.—TRANSFERRING MOTION.—I wish to run a small circular saw (24 inch) with a turbine water wheel. Is there any objection to putting a drum on the vertical wheel shaft and running a half twist belt from it to a horizontal shaft from which to drive the saw, instead of using cog wheels to turn the angle?—W. F. W.

10.—ACTION OF RUNNING WATER ON LEAD PIPE.—The water used for drinking purposes, in my house, is conducted from a spring in the ground through about 1,000 feet of three quarter inch lead pipe. The water is constantly running, and has a fall of about four feet. I wish to know if the water may be poisonous, or if any of the lead is decomposed by the action of the water in flowing through the pipe?—G. G. E.

11.—WATERPROOFING MUSLIN.—How can I make a light muslin tent waterproof without painting or oiling it? I wish to use this tent in all kinds of weather, and wish it to be light, so as to be easily carried.—W. H. J.

12.—FORCE OF FALLING BODIES.—We have a steam hammer weighing exactly three tuns, including piston and rod; the stroke is four feet, and the hammer falls by its own gravity. What will be the force of the blow, making no allowance for friction? What is the formula for the calculation?—J. E.

13.—SPECTACLES.—Can any of your readers inform me if there is any article in use that is better suited to the human eyes than spectacles, and if the articles called "eye sharpeners" have proved a success or not?—J. Y.

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Facts for the Ladies.—Mrs. E. A. Mac Rae, Shoe Heel, N. C., has used her Wheeler & Wilson Lock-Stitch Machine since 1857 with perfect success in every respect, stitching the clothing for 30 colored servants and a large family of whites, and army clothing and hospital bedding during the war, without the slightest repair. It is now as good as when bought. See the new Improvements and Woods' Lock-Stitch Ripper.

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Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

A. C.—It would not be a bad idea for you to advertise your articles in the SCIENTIFIC AMERICAN. You will find it to be a good investment.

MINERAL SPECIMEN.—To W. M. F.—Your specimen is subacetate of lead with some carbonate.

UNIT OF MEASURE.—To L. W. S.—Your suggestion, that a measure derived from the diameter of the sun should be used, can hardly be called novel. The French metric system is based upon the magnitude of the earth, the meter being the forty millionth part of the estimated circumference measured over the poles; and all the French measures of surfaces and solids, as well as the weights, are calculated from the lineal meter, which is 39·37079 inches, nearly.

PHOSPHATE OF CHALK.—A. H. C., in SCIENTIFIC AMERICAN, May 4, asks how the phosphate of chalk, used in Holmes' signal, is prepared. No such thing as a phosphate of chalk exists; nor is phosphate of lime, which, perhaps, he means, capable of being used in this signal. The substance used is phosphide of calcium. It may be prepared by kneading slaked lime into small sticks like a lead pencil, igniting them, and passing phosphorus vapors over them, at the same time heating the lime. Care is required in this, as in all experiments with phosphorus, to prevent a conflagration.—J. S.

POISONOUS COLLARS.—S. K. should burn the collar and test the ash with sulphuretted hydrogen, or sulphide of ammonium. If much lead is used, as on many business and visiting cards, a drop of sulphide of ammonium produces a black stain.—J. S.

PARIS GREEN OR SCHWEINFURTH GREEN.—This is aceto-arsenite of copper. Mr. Charles Schofield, of Indianapolis, formerly a student in Swarthmore College, Pa., died last summer from inhaling a minute quantity of Paris green, while putting it on potato vines. The composition given in Dingler's *Polytechnisches Journal*, Vol. LII, page 271, is oxide of copper, 31·29 per cent; arsenious acid, 58·65, and acetic acid 10·06. It is thus written:

$$3CuO, AsO_3 + CuO, C_4H_3O_3.$$—J. S.

BLACK BOARD.—Query 17, May 4.—Take shellac varnish, lampblack, and flour emery, mix and apply with a camel's hair varnish brush. If too thick, thin with alcohol.—P. J. D.

POISONOUS COLLARS.—To S. K., query 1, page 330.—Boil a piece of collar in diluted nitric acid. Lead will be indicated by a yellow color on the addition of iodide of potassium, and by a black, on addition of hydrosulphuret of ammonium, or solution of sulphuretted hydrogen.—E. H. H., of Mass.

STAINING HORN.—E. C. S., query 7, page 330, may do this by immersing the horn in a solution of nitrate of silver, and then exposing it to sunlight. Or it may be steeped in a hot dilute solution of bichromate of potash, and then in a decoction of logwood. Staining the hands will entirely depend on their coming in contact with the dye or not.—E. H. H., of Mass.

DISSOLVING WOOL OUT OF MIXED FABRICS.—To J. S., query 12, page 330.—Muriatic and sulphuric acids are nearly useless for this purpose. Boil the rags in a mixture of one part of nitric acid and ten of water, or a little stronger. The cotton fiber, after drying, can be shaken out as dust in a willowing machine, leaving the wool behind ready for dyeing. This is the plan adopted in England and Germany for making "extract," and is used for mixing with wool in many manufactures. This prepared wool, however, will be found to have lost, to a great extent, its felting property.—E. H. H., of Mass.

CEMENT FOR TEXTILE FABRICS.—To E. F., query 18, page 330.—Use a solution of gun cotton in ether, that is, collodion.—E. H. H., of Mass.

REMOVING INK STAINS FROM PAPER.—To R. W. A., query 14, page 330.—The ease with which this is done depends on the composition of the ink. If, besides being a mere tanno-gallate ink, it also contains indigo, as most really first class inks do, it will be an impossibility to remove the stains without destroying the paper. Moreover, printing paper is sized very differently from writing or cheque paper. If the surface is well sized, it may be comparatively easy to obliterate the stains, but in the case of thick spongy printing or book paper, the ferruginous particles of the ink will be so incorporated with the substance as always to leave some stain, whether containing indigo or not. Best English inks contain indigo; hence their value as indelible writing fluids.—E. H. H., of Mass.

SUPERHEATING STEAM.—To R. H. E., query 1, page 354.—Steam cannot be so superheated in metal pipes without decomposition.—E. H. H., of Mass.

ANNEALING STEEL.—To U. E., query 5, page 330.—The best way I have found to anneal small pieces of steel is to take a piece of gas pipe, two or three inches in diameter, and put the pieces in it, first heating one end of the pipe and drawing it together, leaving the other end open to look into. When the pieces are at a cherry red heat, cover the fire with saw dust. Use a charcoal fire, and leave the steel in over night. H. C. R., of O.

HYDROGEN LAMP.—To L., query 13, page 330, current vol. 1st. If the tube emitting the gas does not point upwards, attach another piece of rubber tubing or an elbow of any other tube so as to allow a jet, of the gas to be tested, to flow into the uppermost part of an an inverted wide mouthed two or four ounce bottle. If the gas is making rapidly, or you can see from the lowering of the water in the outer jar that your bottle is probably full, still keeping the bottle inverted, as from the lightness of the gas it will stay in the inverted vessel, remove the bottle gently from the pipe or tube, and apply a lighted match to the lower open mouth of the bottle. If the gas explodes loudly, and no flame remains in the bottle, it is dangerous to light the lamp. If it merely takes fire, and a very light bluish flame plays about the bottle or in it for a few seconds, it is pure hydrogen, and then it is safe to light the lamp. 2d. If you make your hydrogen in a simple bottle or jar, allowing it to pass through a tube inserted in the cork, you cannot stop the formation of the gas by closing the tube. If you make it as J. S. directs on page 298, the apparatus is self regulating, making gas only as you use it out of the inner jar, though the cover of the outer jar must not fit air tight, and there had better be free communication from the surface of the liquid in the outer jar to the open air. 3d. An apparatus of the size J. S. describes, if used often, will need renewing in a very few days—in one or two days—unless you make the cork much tighter than can usually be done. It takes a very close joint to confine hydrogen.—S. H. B., of N. H.

NITRIC ACID STAINS.—To S. H. F., query 2, page 354.—These cannot be removed from cloth, though, if the acid was diluted, the color may be modified by the application of an alkali—say ammonia.—E. H. H., of Mass.

ACIDULATION OF ALE.—To W. H. C., query 4, page 354.—This is the result of the acetous fermentation. The alcohol in the ale, absorbing oxygen from the atmosphere, is converted into acetic acid. The prevention may be effected by excluding the air by a tight bung.—E. H. H., of Mass.

ELECTRO-DEPOSITION OF IRON.—Query 5, page 354.—I quote from Napier's "Electro Metallurgy": "Iron may be deposited from a solution of its sulphate in water with a few drops of sulphuric acid added. Use a weak solution and a small battery."—S. G. S., of N. Y.

NITRIC ACID STAINS.—Query 2, page 354.—Apply very carefully, to the nitric acid stain, *aqua ammonia*. Do not use the ammonia stronger than is necessary to remove the stain.—S. G. S., of N. Y.

VACUUM IN CASKS.—E. H. H., in reply to J. A. P., query 6, page 233, says the weight of the air is more than sufficient to hold up liquor in casks, if the liquor would only stick together; but the liquor slips sideways, and so, although the lighter of the two, comes to take the lower place. And does E. H. H. hold that a viscid liquor, like molasses, can be held suspended in pumps to better advantage, and of course at a higher level than water? The power of the air to resist the descent of the liquor can surely not be at a disadvantage from want of mobility of the particles upon one another, as compared with the particles of liquor. Is it not, rather, that what we call gravitation, as exemplified conspicuously in fluids, is a tendency to a vertical movement—that the air does not seek to enter in, but is forced up by a screw motion of the liquor, which screw motion is prevented when paper or other like firm material intervenes? The liquor, that would otherwise be upheld, descends by dint of a mechanical power, the screw, which is made up of the tendency to vertical motion and viscidity conjoined. The old doctrine that terrestrial gravitation takes a bee line towards the earth's center has, moreover, other phenomena opposed to it; witness the course in its descent of a bullet shot from an exactly vertical rifle. What if we add the variation, from a perpendicular, of the plummet suspended from the collar of a deep shaft?—X.

WIND MILLS.—In answer to several enquiries on this subject, I wish to say: The direct force of the wind acting on windmill sails is resolved into two forces, one acting in the direction of rotation, the other in that of the axis. This latter gives no mechanical effect, but, on the contrary, ncreases the pressure on the pivot of the wind shaft and causes loss of effect. Your mathematical readers can easily resolve the primary force into its resultants, and calculate the best angle of impulse for the maximum effect, etc. For the benefit of the general reader, who is not so fortunate as to possess these advantages, I give the results of theory and practice, sufficiently accurately for general purposes. In especial cases, requiring care, a competent person should be consulted. A mathematical and practical view of the case can be found in Weisbach's "Mechanics," Vol. II, from which the following *data* are condensed: A windmill sail consists of the arms or whips, the cross bars and clothing. The arm is divided into seven equal parts. The sail commences at the first point of division. The cross bar at this point is made equal to one of these divisions, or sometimes one sixth the length of arm. Each successive cross bar increases in length to the last or outermost, which is made from one third to two fifths the length of arm. The arms are not generally made the center line of the sail, but they divide them so that the part next the wind equals from one fifth to one third of the entire width of sail. Owing to the greater velocity of the sails at their outer ends, the angle of impulse here should be greater than near the center. If the cross bars are put on the arms, commencing at the first division next the center, so as to make the following angles with the direction of the wind or, which is the same thing, the axis of rotation, 63½°, 70°, 74½°, 77½°, 79½°, 81°, 82°, the result will approach a maximum sufficient for ordinary cases. The best velocity at their periphery is 2½ times that of the wind. The power of the machine will vary so greatly that no definite area of sail can be given for a certain power. If actual work is to be done, it is better to always have power enough and to spare, in this as in everything else where power is required. I would suggest no less than 150 square feet of sail to each horse power.—C. A. L., of Tenn.

Business and Personal.

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Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

HARVESTER RAKE.—William H. Hurlbut, of Mirabile, Mo.—This invention relates to apparatus connected with reaping machines for the purpose of removing the cut grain from the platform of the machine, and consists in mechanism for operating the rake. The operating lever receives a vibrating motion from the reaper, produced in any of the well known ways, which is imparted to a plate and shaft by means of a curved rod and pivoted bar. This motion is equal to about one fourth of an entire revolution, and the rake is made to describe about one fourth of an entire circle by means of projecting lugs on the plate. In addition to this circular sweeping motion of the rake, it is necessary that it should have a revolving motion, in order to raise and depress the teeth. This is produced by means of a horizontal arm which is rigidly attached to the shaft, a curved arm which is rigidly attached to the rake head, and a connecting rod. As the shaft is vibrated, the rake head will be turned about one fourth of an entire revolution. This raises the teeth of the rake to an upright position when they sweep back from the cutter bar, and the revolving motion depresses them to a horizontal position when they return.

CAP BOX.—Albert F. Gove, of Lincoln, Vt., assignor of one half his right to James Henry Batchelder, of same place.—This invention consists in adapting a cap holder to deliver caps, either with or without flanges. For caps with flanges at the top, such as army regulation caps, the upper edges of the side walls are notched sufficiently to allow them to pass. As such notches do not affect the usefulness of the instrument for caps without such flanges, it can be used for both kinds.

SEED PLANTER.—David Lorriaux, of Ottawa, Ill.—This invention furnishes an improved seed planter, which is so constructed that the dropping device may be operated automatically by the advance of the machine, and so that it may be adjusted to work faster or slower by the driver while the machine is in motion. It consists of various parts and cannot be described in detail for want of space.

SCREW DRIVER.—John A. King, of Jamaica, N. Y., assignor to himself and G. L. Peck, of same place.—This invention is an improvement on that for which letters patent were issued to W. S. Goss, August 4, 1868. The parts composing the ratchet mechanism are so constructed and arranged that they occupy less space and are better adapted to endure severe strain or torsion of the instrument.

CANAL BOAT.—I. Joseph Hilgerd, of New York city.—This invention has for its object to improve the construction of canal boats, so as to enable them to be propelled through the water with greater velocity and without injury to the banks; it consists in the following construction: Two wheels, made in the form of frustrums of cones, placed apex to apex, are attached to the shaft to which the power is applied. They are made air and water tight, and have paddles or blades, slightly inclined or spiral, attached to their conical surfaces. The walls of the forward part of the boat at the sides of the wheels are made double, and air and water tight, to serve as floats to buoy up the bow of the boat. The boat is made with two keels, one upon each side of its bottom. The keels are made air and water tight, to assist in floating the boat. They also form a channel or water course along the center of the boat's bottom to receive the water from the wheels to prevent the banks from being washed by the swell. They also prevent the boat shaking. Two rudders are used—one at the rear end of each keel. They are made triangular in form to prevent them stirring up the sand or mud in the bottom of the canal in shallow water, and are connected by a cross bar to the center of which the tiller is pivoted. The tiller is pivoted to the tiller post at the center of the rear part of the boat. By this construction, the boat draws less water while carrying a heavier load than boats constructed in the ordinary manner, and at the same time the wheels cut down the water in front of the boat and force it inward and rearward through the channel in the bottom of the boat, so that it loses its force before being discharged at the stern, and thus prevents the formation of a swell which might injure the banks, and enables the boat to be propelled faster than ordinary boats can be.

SCROLL SAWING MACHINE.—John D. Powers, of Orwell, Vt.—This invention consists of a hand power scroll or jig saw, in which a cranked driving pulley is mounted with the crank under the right hand end of the saw table, where it can be reached readily by the right hand for turning, while the left hand guides the work to the saw. From this driver a pitman shaft, directly under it, is driven by a belt and small pulley, and a pitman directly under the saw connects with the apex of a triangular frame pivoted at a considerable distance to the rear of the saw, and beyond the pivot connected by swivel jointed rods with the rear of a similarly constructed and pivoted frame, between which two frames, at the front ends, the saw is stretched by the swivel jointed rods. The saw is connected, at the lower end, to a rod, to the lower end of which the pitman is connected; and the upper end is connected to an iron plate capable of rising and falling, in the end of the upper frame, and having a short eccentric lever in the upper end, for raising and lowering it to make the saw fast and loose. A bellows is applied for blowing the dust away from the work, and it is so attached to the working gear that the blast is made when the saw is moving up, in order to divide and equalize the work between the up and down strokes.

CORN POPPER.—Albert F. Curtis and Orin N. Palmer, of Delaware, Ohio.—The corn popping vessel is a cylinder made of wire cloth or perforated metal with tight heads of tin or other sheet metal. One head is stationary, while the other is hinged, so as to open and close. The handle may be of wood or metal and of any desired length. It is connected with the cylinder by means of wires, the ends of which lap on to the handle, and are fastened by a sliding ferrule. The ends of the wires are turned and pointed so that they take hold of shoulders in the handle, and when pressed down the fastening is complete. These wires are bent so as to clasp and hold the stationary head to the cylinder. Other wires bend up and over the head and extend to the cover on the outside of the cylinder, forming the pintle of a hinge for the cover on one side, and a fastening hook on the other. The end of the fastening wire passes through a band at the end of the cylinder, and through a narrow radial slot in the cover near its edge. The hook projects beyond the surface of the cover and catches on the same at the inner edge of the slot, the elasticity of the wire on whose end the hook is formed, serving to retain it in this position. Thus the cover is held or clamped upon the band. To release the cover, the wire is pushed outward, which throws the hook into the slot and allows it to rise. Directly beneath the head, all the wires are brought nearly in contact with each other, where they are confined by a ring.

AXLE.—George W. Ray, of Rankin's Depot, Tenn.—In this invention the wheels are cast with or upon, or are shrunk upon, the ends of the axles or spindles, so as to be a solid part of, or immovably attached to them. One spindle is used for each wheel. The spindles are made long, and revolve in bearings attached to the under side of a wooden bolster. They are placed parallel with each other, and in the same horizontal plane. The spindle, when made long, may be made tapering or of uniform diameter, as may be desired, and they are kept from longitudinal movement in their bearings by collars formed upon their journals and working in grooves in their bearings.

NAIL EXTRACTOR.—Edward A. Franklin, of Brenham, Texas.—The object of this improvement is to produce an instrument for readily extracting nails, tacks, brads, etc., from the matter into which they have been forced, which will increase its effectiveness in equal ratio with the resistance offered by the object under operation. The invention consists in a novel arrangement of levers and claws which cannot be fully described without the aid of a drawing.

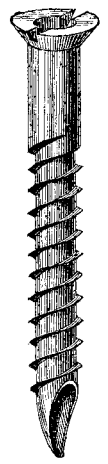
DRIVING BIT.—CharlesHuie, of New York city.—This invention furnishes an improved horse's bit, which gives the driver full control over the horse, and at the same time is easy upon the horse's mouth; it may be so adjusted as to relieve his mouth when sore, and allow it to heal. It consists in bars, link plates, and rings, so constructed that the bars may be readily adjusted closer together or further apart, or the link plates may be detached and replaced with longer or shorter ones, as may be required. The bars, when in use, lie loosely in the horse's mouth, and the horse is guided by pulling upon the lower one. Should the horse become frightened or be ugly or vicious, by pulling strongly upon the reins the bit acts as a lever to force the horse's jaws apart, and at once subdues him.

MACHINE FOR MANUFACTURING ICE CREAM.—Charles Gooch, of Cincinnati, Ohio.—This is an apparatus designed to be used in manufacturing ice cream in large quantities, and is adapted to the production of different flavors and qualities of the article in a more expeditious manner than heretofore. It consists of an arrangement of a horizontal driving shaft in such relation to a series of vertical driving shafts and parallel horizontal ways, on which the cream receptacles are moved up to and away from the said vertical shafts, to allow their dasher stems to be coupled therewith, so as to adapt the driving shaft to operate the dashers singly and successively, or simultaneously.

GRAIN METER.—Robert Rutherford, of Belleville, Ill., assignor to himself and Jasper Messenger, of same place.—This invention has for its object to furnish an improved apparatus for weighing grain as it comes from a thrasher, elevator, or other place, and consists in the combination of a box and a weighing lever or balance, and various other parts operating together as follows: When enough grain has been received in the box to overbalance the weight, the box descends and at once closes valves which prevent any more grain entering the box until the grain already there has been discharged. When the box has descended sufficiently, other valves drop down, allowing the grain to flow out into a receiver placed beneath the apparatus to receive the weighed grain. As the box is lightened by the escape of the grain and rises, the valves return to their places, closing the lower end of the box to again receive grain. By this arrangement, the operation of the weigher is automatic, and all the attendant has to do is to count the number of discharges to know the exact amount of grain weighed. The counting may be done, if desired, by an indicator connected with the apparatus.

WATER WHEEL.—Levi M. Sharps, of Alanthus Grove, Mo.—This invention furnishes an improved water wheel, which is constructed to utilize the greatest possible per cent of the power of the water, by improving the construction of the buckets so as to produce the best effect, and the construction of the guide chutes so that they may support the weight of the column of water, and deliver it squarely against the faces of the buckets. It cannot be described in detail without the aid of drawings.

WOOD SCREW.—Edwin S. Wills, of 917 Ridge street, Philadelphia, Pa.—The first part of this invention relates to a spoon shaped point to the screw for forming a boring and tapping device, so as to dispense with the necessity of boring the wood previous to the insertion of the screw. The second part relates to a central bore of the screw from the concavity of the point throughout its whole length for the passage of the borings. The accompanying engraving fully explains the device. This screw will not split the wood, as the spoon point cuts through the fibers and the central bore allows ample space for the chips. Machine screws made on this principle are found to operate well. They are made with a square head instead of the slotted head represented in the illustration. In putting ordinary screws into hard wood, the friction attendant upon the thread crowding the fibers out of place is very great, and it is hard work to drive the screw. With the improved screw, the fibers are cut through by the tapping point sufficiently to remove a portion of the friction and to secure easy driving, but not enough to prevent the screw retaining a tight hold on the wood.—Patented April 30, 1872.



BOTTLE CAPPING MACHINE.—August C. Jordan, of New York city.—This invention relates to a machine for quickly and exactly applying tin foil or other thin caps over the corked ends of bottles or jars; and consists in the arrangement of rotary spring jaws for pressing the foil against the neck of the bottle, and of a sliding spring button for holding the head of the cap against the stopple or cork.

MODEL STAND.—George A. Gilbert, New York city.—This invention relates to a new apparatus to be used as a support for models, to be drawn, painted, or otherwise imitated by artists, and also for boards or stretched canvas to be drawn upon. It consists in the arrangement, on an upright rod or post, of a sliding plate and adjustable cross bar, the plate serving as a support for models, the cross bar as a means of steadying wider articles, or to suspend pendent things. By this means, a stand which can be used as a support for all sorts of articles is produced at small cost and in simple form.

BOLT THREADING MACHINE.—George W. Frosst, Richmond, Va., assignor to Archer, Goodwin & Co., of same place.—This invention consists of an automatic reversing and stop motion for machines for screwing thread bolts. It is also applicable for nut tapping machines. The device is composed of so many parts as to render a description impossible unless aided by drawings.

COTTON PRESS.—James W. Miller, Shannon, Miss.—This invention consists of a lever toggle, jointed bars, and a windlass or capstan working the follower, the lever being connected by its short arm to a stem rising up from the follower, and by its long arm to the toggle jointed bars. A capstan is used to force the arms together by a rope and pulleys.

STREET CAR.—John Stephenson, New York city.—These improvements are intended to apply more particularly to the front doors of cars which are under the control of the driver. They consist, first, in suspending the sliding door on ways (which are so placed as to conform to the shape of the car roof) and thereby securing ease of motion; and, second, in providing a sliding car door with sliding panels therein, so that the car may be ventilated, and the driver easily communicated with by the passengers.

FRONT GEAR FOR CARRIAGES.—Charles L. Leonard, Wells' Bridge, N. Y.—This invention consists in the construction and arrangement of the various parts in such a way that the king bolt is supported laterally throughout so much of its length that it is prevented from vibrating or tilting over sidewise, as it does when the hole or tube through which it passes is shallow. Very great strength is obtained, both vertically and laterally, with very light bars and stays, and the king bolt is firmly supported against being swayed laterally in its support by the carriage body.

HORSE SHOE NAIL.—Joseph Jorey, Norwich, Conn.—This invention relates to a new and useful improvement in the construction of nails for shoeing horses, and consists in forming the heads of such nails partly of iron or soft metal and partly of steel or hard metal, so that the heads may be made to serve as calks and be self sharpening, while they serve to hold the shoe to the horse's foot.

TICKET HOLDER.—John W. Rockafellow, Stockton, N. J.—This invention furnishes, for the use of railway or other ticket sellers, a ticket box or holder, so constructed that the withdrawal of tickets may be effected more readily than heretofore. The ticket box may be of any depth, according to the hight of the pack of tickets it is required to hold; and in horizontal section, its internal size will be a trifle larger than the dimensions of the tickets. It is hinged to any suitable support, and has a slot through the lower back, just above the bottom, about as wide vertically as the thickness of a ticket, and also a slot through the front that will allow a ticket to come out. A thin plate or pusher extends into it above the bottom a quarter of an inch, more or less, in such manner that, when the box is swung forward at the bottom, the rear end of the ticket resting on the pusher is brought in front of the end of the pusher, and will fall to the bottom of the box, where it will be thrust out through the slot when the box goes back, so that it can be readily taken hold of to be pulled out.

BAG HOLDER.—Ethel L. Lyon, of Steamburg, N. Y.—This invention consists of a set of hooks or holding points on bars arranged on a table in such manner that the points may be readily brought together over the center of the filled bag to fold the top for tying; when detached from the filled bag they are swung back to the positions for holding the empty bag open by a weight and spring, or other equivalent device. There is a treadle below the table, adapted for supporting long or short bags, to take the strain off the hooks and to raise the bag for detaching it from the hooks.

CHURN.—Josiah Mayes, Oxford, N. Y.—This invention pertains to an improvement in the class of reciprocating churns provided with guides for the dasher, and it consists in the combination of shoes of friction plates with the dasher and vertical guides by which friction is obtained; which, in connection with the agitation caused by the dasher, will bring the butter in a very short time, and will develop all the butter there may be in the milk.

BOW.—Ephraim S. Morton, Plymouth, Mass.—This bow consists of a straight piece of strong wood, and two springs of steel wire, one attached to each end of the central piece. This attachment is made by inserting the inward ends of the springs in holes in the central piece, and connecting their outer ends by the bow string. These springs are coiled, near the ends of the center piece, to give greater elasticity; and beyond the coils they are curved suitably to constitute the bow, and they are made either double or single. The object of having the springs connected to the center detachably is that they may be taken out and packed in a box more compactly than they otherwise would be.

BAND SAW GANG.—William J. McLane, New York city, assignor to himself and Henry Silliman, of same place.—This invention relates to a new and useful improvement in machinery for sawing lumber and marble. The lower pulleys on which the saws run are made fast to the driving shaft, and are arranged on it in the form of a cone pulley. The upper corresponding pulleys are separate, and loose on an arbor. These pulleys are provided with recesses which allow the teeth of the saws to overhang the particular pulleys to which each saw is attached. This arrangement allows the plate of the saw to lie flat upon the pulley, and so that the set of the saw will no interfere. The gangs may be used either vertically, horizontally, or in an inclined position, as may be desired.

SEWING MACHINE.—Carlos Stebbins, Pike, N. Y.—This invention relates to improvements in regulating the tension on the threads used. A vibrating upper thread controller connects with the driving mechanism, and is governed in its movements by a peculiarly slotted double cam; while the shuttle is provided with a plate which confines the thread according to the degree of strength imparted by an enclosed spring.

HEATING AND COOKING RANGE.—William A. Greene, Brooklyn, N. Y.—This invention consists in arranging heating chambers at the sides, back, and front of the fireplace of the stove, in a manner which would require drawings to fully illustrate. It also includes an arrangement of fire brick on the top plates of the oven.

COMPOSITION FOR COVERING CIGAR TIPS.—John H. Harris, of Pittsfield Mass.—The object of this invention is to protect the tips of cigars from contact with the mouth of the smoker, in order to prevent the saliva absorbing any injurious ingredients or injuring the tobacco. The substance used for this purpose is collodion mixed with any adhesive matter, such as gum shellac or rubber. This compound is formed into a paste and applied to the point of the cigar. Being waterproof, it separates the saliva and tobacco in an efficient manner.

PACKING CASE.—Thomas Scantlin, of Evansville, Ind., assignor to himself and James M. Scantlin, of same place.—This invention furnishes a case for inclosing and protecting cans of oil or other liquids or substances in the course of transportation, storing, or sale; and it consists in a case constructed of metal, or of metal and wood combined, provided with a gate for the discharge orifice or spout of the enclosed can. The discharge tube of the can is placed just below the top or end thereof, and projects through the case so that the contents of the can may be discharged without taking it from the case. A gate slides down over the end of the discharge tube so as to securely confine the cork which closes it.

MACHINE FOR SAWING FELLIES.—John B. Zimmerman, of Fort Seneca, O.—This invention consists in improving the construction of machines used for sawing both curved sides of a felly. The frame, gate, connecting rod, crank or driving wheel, and the table, are substantially like the ordinary sawing machines of this character. Two saws are arranged in the gate, as far apart as the depth of the felly to be sawed, so as to saw both the outer and inner curves at once; and they are arranged for adjustment toward or from each other by having the straining bolts fitted in slotted plates to vary them for fellies of different thicknesses; a circular carriage is pivoted at the side of the saws, the pivot being as far from the saws as the radius of the wheel for which the fellies are designed; the carriage is provided with numerous center holes for the pivot pin, to shift it for cutting fellies for wheels of different sizes. Spring clamps are arranged on the carriage so as to clamp the plank to be sawed at each end and hold it while sawing.

ATTACHING KNOBS TO THEIR SPINDLES.—Andrew S. Gray, of St. John, Canada.—This invention consists in the arrangement of a forked spindle, a knob with a tubular shank, and an eccentric or cam which can be turned to clamp the spindle and fasten the knob to it. This arrangement is a substitute for the screw fastening now in use, and dispenses with the necessity of perforating the spindle at certain places to fit the thickness of various sized doors.

GRAIN SEPARATOR.—John L. Custer, of Bonaparte, Iowa.—This invention furnishes an improved timothy and other grass seed cleaner, for attachment to thrashers and separators, and consists in the following construction: To the ordinary framing, casing and vibrating shoe are added a riddle and a carrier or stirrer, by the action of which chaff, stalks, etc., are carried back and the grain separated; part passing down through the machine to the floor or grain box, and the remainder being carried back to the thrasher.

WATER WHEEL.—Tenison Chesher, of West Middleburg, O.—This invention relates to an improvement in water wheels, and consists in a construction and arrangement of parts which cannot be fully shown without drawings. Half the chutes are stationary and half movable, and when the movable chutes are drawn back from the stationary chutes, a wedge shaped opening between them is preserved at all times. The current of water is not broken before it strikes the bucket of the wheel, and the full force due from a small quantity of water as well as from a large is secured.

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How Can I Obtain a Patent?

is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them: they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

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Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible, and send by mail. An answer as to the prospect of a patent will be received, usually by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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Inventions Patented in England by Americans.

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From May 3 to May 13, 1872, inclusive.

CARDING ENGINE.—J. F. Foss, Lowell, G. E. Taft, Worcester, Mass.
CENTRIFUGAL MACHINE.—J. Cattle, Boston, Mass.
CLAMP FOR JOINING ROPES.—T. H. Alexander, Washington, D. C.
COMPOSITION STONE.—J. Anderson, New York city.
COMPRESSING METALLIC ARTICLES.—J. B. West, Genesee, N. Y.
CURING TOBACCO.—J. D. Culp, Gilroy, Cal.
ELECTRIC TORCH.—W. W. Batchelder, New York city.
EYELETING MACHINE.—J. E. Wiggin (of Massachusetts), Middlesex, Eng.
KNITTING MACHINE, ETC.—W. R. Ramsdell and J. E. Crane, Lowell, Mass.
LUBRICATING COMPOUND.—B. French, Rochester, N. Y.
MAKING NETS.—G. B. Lewis, W. M. Ward, East Boston, Mass.
PNEUMATIC SIGNAL.—A. G. Myers, New York city.
PRINTING TELEGRAPH.—T. A. Edison, Newark, N. J.
PUDDLING APPARATUS.—H. A. V. Post.
ROTARY ENGINE.—G. B. Massey, New York city.
SPINNING MULE.—J. Sutherland, East Hampton, Mass.
STEELIFYING IRON.—T. Sheehan, Dunkirk, N. Y.
TRACTION ENGINE.—G. W. Fitts, Philadelphia, Pa.
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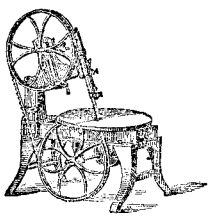

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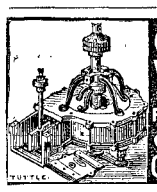

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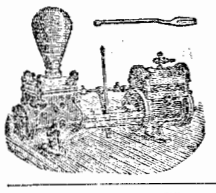

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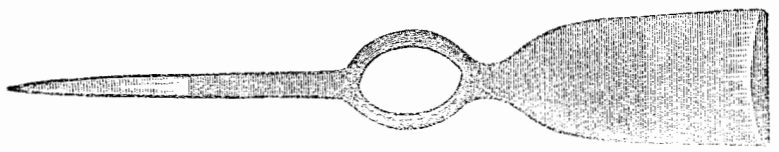

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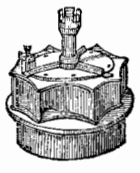

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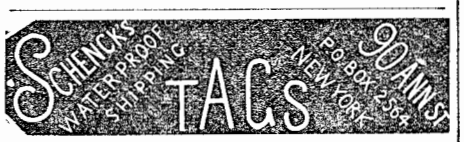

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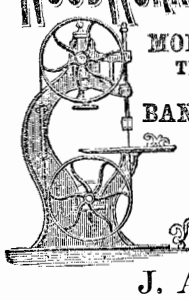

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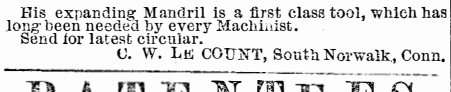

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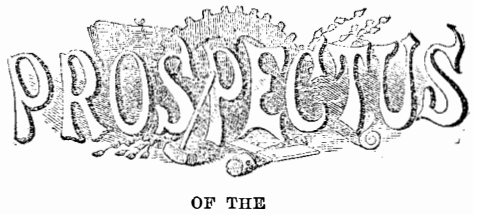

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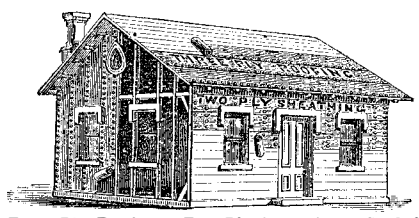

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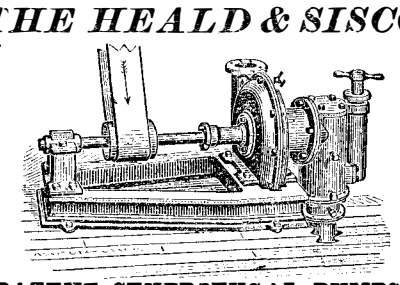

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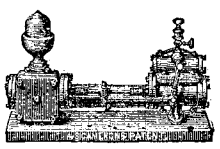

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The following correspondence explains itself:

COVERT, Van Buren County, Michigan, April 9, 1872.

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GENTLEMEN—Your Household Magazine gives good satisfaction; in fact, those taking it at this office are happily disappointed. And as for the Organ you ordered, we do not wish a better one. The children are perfectly delighted, and children of a larger growth are generally pleased. Perhaps I can no better show our satisfaction in the success of our undertaking, than to send you the inclosed [following], written [for the South Haven Sentinel] by Mr. O. S. SHAW, the leader of our Choir.

Yours truly,

D. B. ALLEN.

How to Do It.

COVERT, March 18th, 1872.

MR. EDITOR:—On the ninth day of January last, a copy of Wood's Household Magazine strayed into the Covert Post-office, and our Post-master, Mr. D. B. ALLEN, who is also Superintendent of our Sabbath School, in glancing over the contents, noticed the offer to any Club, Lodge, or Sabbath School, of a Smith's American Organ, for the price of the instrument in subscriptions to the magazine. Here, thought our Superintendent, is our opportunity; we need an Organ, and we need good reading—why may we not have both? The price of the Magazine is one dollar per year, and for one hundred and twenty-five subscribers we can have a No. 1 Organ, price $125. With charcteristic promptness he presented the matter to the school next day, and, though the scheme appeared visionary to the most of us, the ball was set in motion, and it was not suffered to rest until one hundred and fifty-three names were obtained, which, with the addition of twelve dollars in cash, entitled us to a Smith's American Organ, style No. 3, price one hundred and sixty-five dollars. The list, with the cash, was sent to the publishers, the Organ was promptly forwarded, and last Sabbath its powerful tones filled our place of worship for the first time. We can cheerfully testify to the reliability of the publishers of Wood's Household Magazine. They give us our money's worth of valuable reading, and, in addition, a first-class Cabinet Organ; and we will further say to all Clubs, or Societies, that are in want of an Instrument, first find a leader who has *go* in him, then GO and do likewise. * * * O. S. S.—[*From the Sentinel, South Haven, Mich., for March* 30, '72.]

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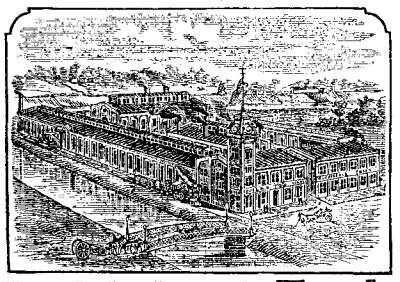

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